(2)

NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

ANALYSIS OF THE JOINT REORGANIZATION ACT'S IMPACT ON PERSONNEL FLOW IN THE SURFACE WARFARE OFFICER COMMUNITY

by

Joseph L. Johnson, Jr.

March 1989

Thesis Advisor: Paul R. Milch

Approved for public release; distribution is unlimited.

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S)	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION NAVAL POSTGRADUATE SCHOOL 6b. OFFICE SYMBOL (If applicable) 55	7a. NAME OF MONITORING ORGANIZATION NAVAL POSTGRADUATE SCHOOL
6c. ADDRESS (City, State, and ZIP Code) MONTEREY, CA 93943-5000	7b. ADDRESS (City, State, and ZIP Code) MONTEREY, CA 93943-5000
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
ANALYSIS OF THE JOINT REORGANIZATION ACT'S IMPACT ON PERSONNEL FLOW IN THE SURFACE WARFARE OFFICER COMMUNITY.

12. PERSONAL AUTHOR(S)
JOHNSON, JOSEPH L. JR.

13a. TYPE OF REPORT	13b TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
MASTER'S THESIS	FROM _____ TO _____	1989, MARCH	101

16. SUPPLEMENTARY NOTATION THE VIEWS EXPRESSED IN THIS THESIS ARE THOSE OF THE AUTHOR AND DO NOT REFLECT THE OFFICIAL POLICY OR POSITION OF THE DEPARTMENT OF DEFENSE OR THE U.S. GOVERNEMENT.

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	DOD REORGANIZATION ACT; FORECASTER MODEL; SWO CAREER PATH; ACTIVITIES; TOURS, Theses. (SDW)

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This thesis introduces a user interactive personnel flow forecasting model, FORECASTER, and demonstrates its use to analyze the effect of the Goldwater-Nichols Department of Defense Reorganization Act on the personnel flow within the Surface Warfare Officer (SWO) community. The emerging problems of filling joint billets with promotable officers while maintaining the support and readiness of the critical fleet units is quantitatively analyzed with FORECASTER and is the focus of this analysis. Two proposed personnel flow scenarios to contend with the DoD Reorganization Act are suggested. One establishes a fixed proportion of officers to be sent from at sea billets to joint billets, while the other considers joint education immediately following postgraduate education. The results of these proposals show an increase in joint billet fills while maintaining the fill of critical fleet unit billets. Keywords:)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL PROF. PAUL R. MILCH	22b. TELEPHONE (Include Area Code) (408) 646-2882 22c. OFFICE SYMBOL CODE 55Mh

DD FORM 1473, 84 MAR 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

☆ U.S. Government Printing Office: 1986—606-24.

Approved for public release; distribution is unlimited.

ANALYSIS OF THE JOINT REORGANIZATION ACT'S IMPACT
ON PERSONNEL FLOW IN THE SURFACE
WARFARE OFFICER COMMUNITY

by

Joseph L. Johnson, Jr.
Lieutenant, United States Navy
B.S., United State Naval Academy, 1983

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
March 1989

Author: _____
Joseph L. Johnson, Jr.

Approved by: _____
Paul R. Milch, Thesis Advisor

_____
Thomas E. Halwachs, Second Reader

_____
Peter Purdue, Chairman, Department of
Operations Research

_____
Kneale T. Marshall, Dean of Information
and Policy Sciences

ABSTRACT

This thesis introduces a user interactive personnel flow forecasting model, FORECASTER, and demonstrates its use to analyze the effect of the Goldwater-Nichols Department of Defense Reorganization Act on the personnel flow within the Surface Warfare Officer (SWO) community. The emerging problems of filling joint billets with promotable officers while maintaining the support and readiness of the critical fleet units is quantitatively analyzed with FORECASTER and is the focus of this analysis. Two proposed personnel flow scenarios to contend with the DoD Reorganization Act are suggested. One establishes a fixed proportion of officers to be sent from at sea billets to joint billets, while the other considers joint education immediately following postgraduate education. The results of these proposals show an increase in joint billet fills while maintaining the fill of critical fleet unit billets.

TABLE OF CONTENTS

ACKNOWLEDGMENT

Special thanks to my advisor Professor Paul R. Milch, the originator of the mathematical core of FORECASTER, for his meticulous guidance throughout this thesis. I am deeply indebted in gratitude to Professor Dick Elster from the Administrative Science Curriculum at NPS and Bill King from DMDC, Monterey, CA, who were instrumental in obtaining the necessary data to conduct the analysis. Finally, to my lovely wife Lois, for her undaunting devotion and assistance for which I am eternally grateful.

I. INTRODUCTION

People are our most important resource. [Ref. 1:p. 187]
-Hon. W. Graham Claytor, Jr.
Former Secretary of the Navy

Human resource planning demands that the leaders of an organization assess the anticipated future conditions that will affect its human resource practices. Mathematical models are an effective tool in estimating the effect of future policies impacting people in the organization.

Bernard D. Rostker in Hughes [Ref. 1:p. 187-188] divides human resource management in the armed services into four distinct entities defined as follows:

- Manpower: determining the numbers and types of people needed to accomplish a task.
- Personnel: managing people to ensure an appropriate type of person is available for a specific activity.
- Assignment: matching available people to specific tasks.
- Training: providing a person with a new set of skills.

Personnel models are most useful in studying the impact of a policy change on the flow of personnel through a system. By introducing changes in the normal (steady state) flow of personnel, it is possible to forecast the effect a policy change may have on the status quo of the system.

Forecasting human resource needs is, indeed, an integral part of successful human resource management. The ability to

calculate or estimate future staffing requirements is vital in maintaining an effective organization. Forecasting has been described as a "process of estimating available supply of and demand for talent based on the best available information." [Ref. 2:p. 100] It provides a manager the ability to foresee the ramifications of altering current policy on the personnel manning of specific jobs in the system.

In the United States Navy, policy changes affecting personnel flows are frequent. While the objectives of the Navy remain relatively constant, the path charted for personnel to achieve those objectives change as the political, global, and budgetary environment change. The Goldwater-Nichols Department of Defense Reorganization Act of 1986 has imposed such changes in the management of military personnel affecting all branches of the armed services and their individual communities, including the Surface Warfare Officer (SWO) community of the Navy.

This thesis presents an analysis of the personnel flow of officers through the Surface Warfare community resulting from implementation of the DoD Reorganization Act. An inbred computer personnel flow model, FORECASTER, will be utilized to conduct this analysis.

II. BACKGROUND

A. JOINT OFFICER MANAGEMENT

Since the establishment of the Department of Defense in 1947, the need to have effective and cohesive armed forces able to conduct successful joint efforts has been a constant goal and struggle for the DoD. In the past, successful military campaigns were the result of effective joint and combined efforts. Recently, though, reports and studies by the Senate Armed Services Committee criticized the "inadequate quality" of joint duty military personnel. "Quality" was to be measured by three ingredients:

- inherent skills and talents as professional military officers;
- necessary education and experience;
- sufficiently long tour to become effective and provide continuity [Ref. 3:p. 1].

Two concepts were introduced in a Senate Armed Services report (October 1985) to deal with these "inadequacies" and are paraphrased as follows:

- Produce officers with a heightened awareness and greater commitment to DoD--wide requirements, a genuine multi-service perspective, and an improved understanding of the other services by changing the current system of military education, training and assignment.
- Establish a joint duty career specialty in each service [Ref. 3:p. 2].

These two concepts were also the cornerstone of the Goldwater-Nichols Department of Defense Reorganization Act of 1986. Among other things, the Act sets out to "provide for more efficient use of defense resources, to improve joint officer management policies, otherwise to enhance the effectiveness of military operations and improve the management and administration of the Department of Defense." [Ref. 4]

A "Joint Specialist" is an officer educated and experienced in a multi-national or multi-service command or activity involved in the integrated employment of land, sea and air forces to achieve national security objectives. To Qualify as a Joint Specialty Officer (JSO), and officer must complete a prescribed program of Joint Professional Military Education (JPME) and a standard length Joint Duty Assignment (JDA), and then must be selected by the Joint Specialty Officer Designation Board convened by the service secretaries. Officers may be designated joint specialty "nominees" by successfully completing a program of JPME or have a critical occupational specialty (COS). Only officers having outstanding performance records can be designated joint specialty nominees. [Ref. 3:p. 5-12]

A critical occupational specialist (COS) is designated by the Secretary of Defense and is selected from the combat arms. Designation is to ensure that joint duty tour length requirements do not lead to significant deterioration of warfighting skills or personnel shortages in operational

fields. With the exception of flag officers, a COS officer who completes JPME and joint duty assignment of at least two years may be designated a joint specialist. A percentage of COS JSO's are required to return for a full tour of duty in a critical joint duty assignment. (A critical joint duty assignment is specifically designated requiring previous joint duty education and experience). [Ref. 3:p. 13-16]

In reviewing the DoD Reorganization Act, clearly Title IV of the Goldwater-Nichols DoD Reorganization Act provides the most influential rhetoric concerning service members' careers. Title IV, "Joint Officer Personnel Policy," establishes strict guidelines for joint officer management, and outlines procedures to carry out the restructuring of the Department of Defense. The following key provisions of Title IV necessitate mention:

- Completion of joint duty assignment (JDA) is a prerequisite for promotion to flag rank.
- Minimum joint tour lengths are two and a half years for flag officers and three years for other officers.
- At least 1,000 JDA's are designated as critical joint billets which will be filled by joint specialty officers.
- 50 percent of all joint duty assignments must be filled by joint specialty officers (JSO's) or nominees.
- Upon graduation from the National Defense University (NDU), at least 50 percent of the class must be assigned to JDA's.
- Promotion rates for officers with joint duty experience are expected to at least equal the promotion rates for all officers of the same armed force in the same grade and competitive category.

- Promotion rates for JSO's and staff members (past and present) of the Secretary of Defense or the Joint Staff, are expected, as a group, to at least equal the promotion rates for officers of the same armed force in the same grade and competitive category who are serving in or have served in the headquarters staff of their armed force. [Ref. 3]

All of the preceding provisions are subject to waiver by the Secretary of Defense. Title IV clearly establishes the framework for joint officer management. Since experience in joint duty assignment is now a prerequisite for flag promotion, the demand for joint tours is likely to become much greater producing more competition to fill joint duty billets, among career minded officers who aspire t attain flag rank.

B. SWO CAREER PATH

The SWO career Path is a considerably rigid course officers must follow throughout their tenure in the Navy. The Surface Warfare Officer is an Unrestricted Line Officer eligible to command ships. The "SWO community" refers to "officers who are qualified in the surface warfare specialty, who man the surface ships of the Navy and whose goal is to command those ships" [Ref. 5:p. 30]. Indeed, command at sea is the ultimate goal and driving force for the career-minded "Surface Warrior."

The typical SWO career path is represented in Figure 2.1. Noticeably apparent is an alternation of shore and sea tours. The sea tours are preceded by professional training in a classroom environment and are mandatory stepping stones in the

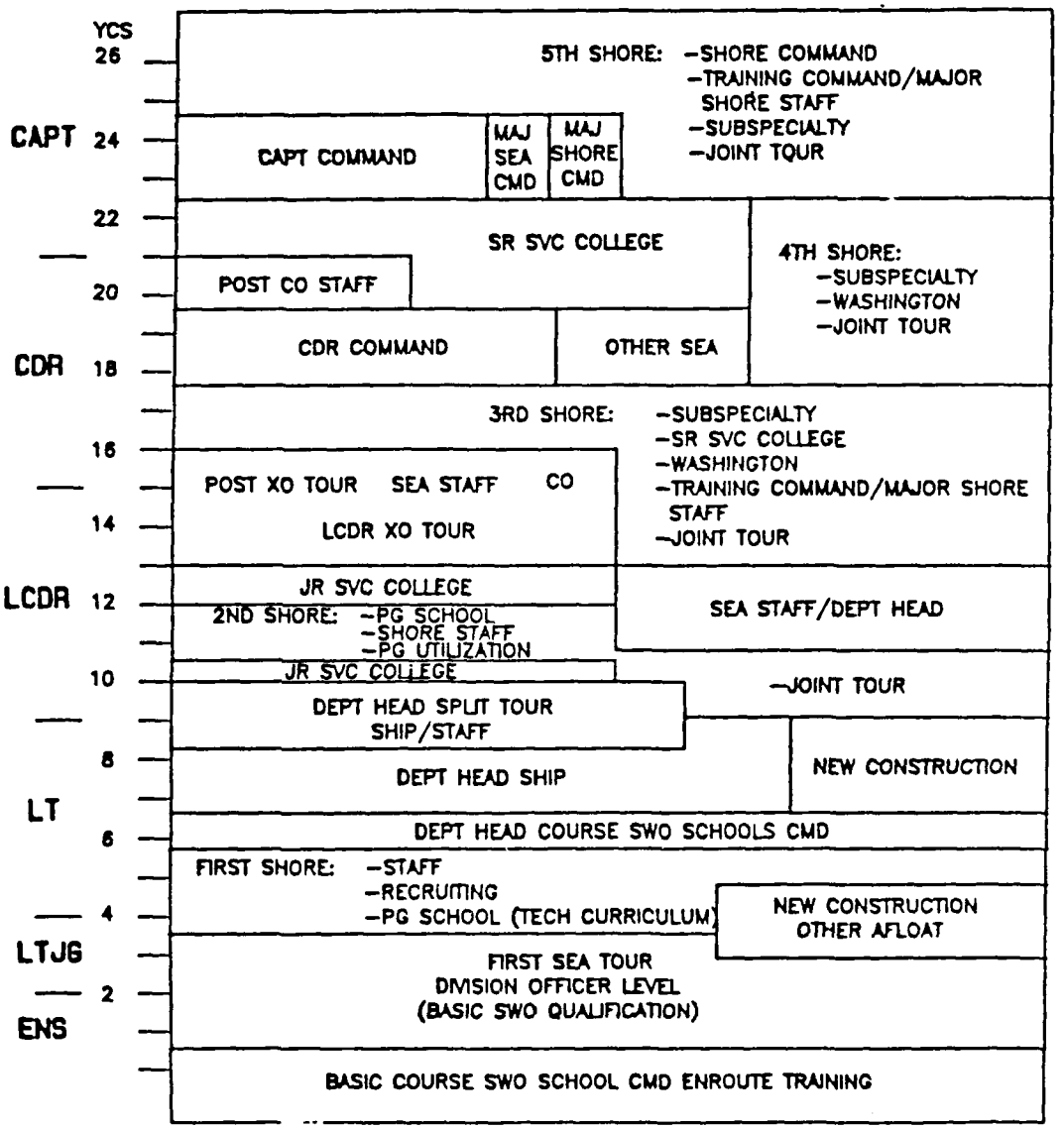


Figure 2.1 Surface Warfare Officer Professional Development Path

SWO career path. The most crucial element in the SWO career path is undoubtedly the at-sea experience. The shore tours allow flexibility for the SWO to pursue personal and/or professional goals that will contribute favorably in the quest for the ultimate reward, that of commanding a surface ship on the high seas.

The Surface Warfare Officer designation is considered to be a Critical Occupational Specialty (COS). As such, an officer may be awarded the joint specialty designation after completing a JPME and joint duty assignment of at least two years in length (initial tour only), regardless of sequence but subject to the possibility of serving in a critical joint duty assignment in the future.

The policies and goals of the DoD Reorganization Act will, without question, alter the traditional career path for SWO's. Requirements such as the two year joint tour, joint professional military education (JPME), joint specialty (JSPEC) officer quotes, and promotion policies established by the Act will impact the flow of officers through the Surface Warfare pipeline.

Specifically, only officers with outstanding performance records will be selected for joint duty assignments. This new emphasis on joint duty experience constrains the Surface Warfare community to fill the joint billets with "promotable" officers. Traditionally, top performers in the SWO community were kept in at-sea billets in order to best contribute to the

fleets' combat readiness. Now, some of these top officers will be tasked with filling SWO allocated joint duty assignments embracing the spirit of the DoD Reorganization Act.

The new milestone of joint duty assignment as a prerequisite for flag promotion consideration is going to cause increased competitiveness among flag aspiring SWO's to fill the joint billets. Thus, the objective of the DoD Reorganization Act--to enhance the quality and organization of the Armed Forces by establishing requirements and incentives for top level officers to experience joint duty assignments--will alter how officers in the Surface Warfare Officer community flow through their "system." What impact, if any, will this have on the ability of the SWO community to man and support the ships at sea? How will it affect sending officers to postgraduate education billets and shore billets? What are the alternative paths officers can follow to better meet the requirements established in the Goldwater-Nichols DoD Reorganization Act without deteriorating the combat readiness and support of the United States Naval Fleet?

III. MODEL

Models do not forecast, people do. [Ref. 2:p. 100]

A. PROBLEM IDENTIFICATION

As discussed in the preceding chapter, the Goldwater-Nichols Act of 1986 provides recent legislation that will affect the current flow of officers in the Surface Warfare Officer community. The standards established by the Act will require the SWO community to send their top performing officers to joint duty assignments. The following questions must be answered to provide proper management of the SWO community:

- Can the current SWO personnel flow system meet the requirements mandated by the DoD Reorganization Act?
- At what cost will the requirements of the Act be achieved, as far as shortages occurring in other billets?
- Which are the alternative personnel flow paths that will enable the SWO community to meet the requirements of the Act without causing critical personnel shortages in any other areas?
- What shape will the new emerging SWO career path take, in terms of deviations from the present career path, as a result of the DoD Reorganization Act?

In order to analyze the impact of the Goldwater-Nichols Department of Defense Reorganization Act and to attempt to answer these questions, the personnel flow model, FORECASTER, will be introduced in this chapter.

B. MODEL DESCRIPTION

FORECASTER is a user interactive descriptive personnel flow model written in APL (A Programming Language). The program (see Appendix A for FORECASTER Flow Chart) runs on the mainframe 3033 system at the Naval Postgraduate School, Monterey, California, but can also be run on an IBM PC so long as APL software is installed. The purpose of FORECASTER is to predict the future distribution of personnel for a user-defined system. Inputs to achieve the personnel flow dynamics will be covered later in this chapter.

The mathematical model is based upon personnel flow being described as a stochastic process. Utilizing transition probabilities of moving, from one "state" to another, flow of personnel is modeled through the system. The resultant output shows the estimated future distribution of personnel in the states (activities) defined for the system.

The concept of modeling the SWO community has been undertaken in a number of theses at the Naval Postgraduate School over the past several years. Howe [Ref. 6] represented the SWO career path as a network, which Amirault [Ref. 7] effectively modeled in a computer program. Mygas [Ref. 8] and Steward [Ref. 9] used and slightly modified Amirault's model to conduct analysis on the SWO career path. These earlier works helped formulate FORECASTER as a tool for analysis in personnel flow problems. Milch [Ref. 10] specifically

discusses the theoretical development upon which FORECASTER is based.

In developing a stochastic model, the two primary elements that require immediate attention are "state" and "time period" [Ref. 11:p. 145]. In this instance, the "states" are the activities representing mutually exclusive job classifications an officer may occupy at any given time. Here, the SWO community has been modeled establishing six activities; a slight modification on those used by Steward [Ref. 9:p. 16]. The activities for the SWO community are reviewed in Table 3.1.

TABLE 3.1

ACTIVITY DEFINITIONS

A. POSTGRADUATE EDUCATION: SWO billets at a postgraduate school (e.g., the Naval Postgraduate School) or war college.
B. JOINT PROFESSIONAL MILITARY EDUCATION (JPME): SWO billets at the National Defense University (NDU) (i.e., the National War College, the Industrial College of the Armed Forces Staff, and the Armed Forces Staff College).
C. JOINT TOUR: SWO billets designed as joint duty assignment billets.
D. SWO EDUCATION: Any course of instruction at a professional training command over 20 weeks in duration; specifically, SWO billets in the SWO Department Head course of instruction.
E. FLEET UNIT: SWO billets in a U.S. naval ship's company or an afloat staff.
F. SHORE: SWO billets primarily in Washington D.C. and other naval shore establishments not meeting the criteria of A through D.

The progression of time is represented by tours. A tour is defined here as a duty assignment in any of the given activities. Here, twelve tour numbers (the maximum allowed in FORECASTER) are used to model the SWO community. Completion of twelve tours is roughly equivalent to having attained the rank of Captain (paygrade 0-6) and/or serving as Commanding Officer (CO) of a major command.

Figure 3.1 graphically represents the SWO community personnel flow as a matrix of activities and tour numbers. Each "node", the intersection of tour numbers and activities, represents billets available at the specific activity and tour number. The lines connecting the nodes represent possible paths along which a SWO may proceed during a career. Each line segment has a probability assigned to it reflecting the chance an officer has of transiting from one activity to another while proceeding to the next tour. For example, a SWO in activity fleet unit, on his first tour, can proceed to either postgraduate education, with probability of .1, to another fleet unit, with probability of .3, to shore, with probability of .2 or separate from the SWO community with probability of .4. Separation here refers to officers leaving this system, and therefore includes leaving the naval service or transferring to another community within the Navy. It is also assumed that all officers leave the system at the completion of their last (twelfth) tour.

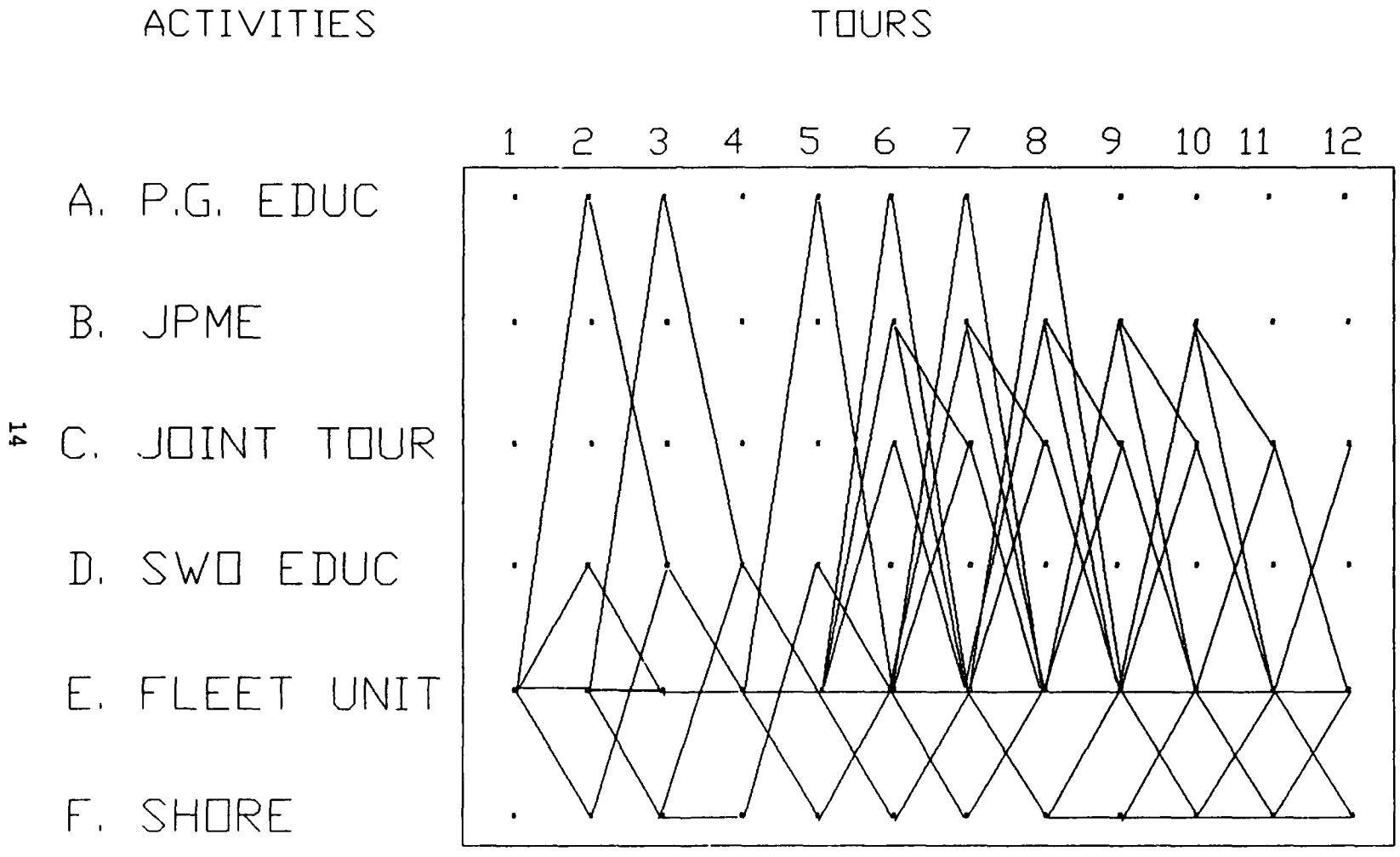


Figure 3.1 Status Quo Flow

FORECASTER is a "transient" model as opposed to a "steady state" or "equilibrium" model. "A transient system is one on its way to equilibrium," while equilibrium refers to "regularity over time" [Ref. 12:p. 10]. As a transient model, FORECASTER computes a forecasted distribution, at some future time, of personnel in the system for the activities and tour numbers defined by the user. FORECASTER displays these predicted values in matrix form with the activities as rows and the tour numbers as columns. The additional information extracted from the output will be covered in a later section.

This mathematical model is best suited to aid community managers as they investigate and analyze personnel flow through their systems. FORECASTER is not a detailer's tool and should not be used in that capacity. The community manager may use FORECASTER as an analytical model to forecast estimated personnel distributions to assist in understanding and possibly better organizing the human resources in the community.

C. VARIABLES

The variables in FORECASTER provide the impetus to answer the various "what if...?" questions concerning personnel flow through the system. In analyzing the impact a policy change may incur on the personnel flow, the variables may be altered to reflect the policy change and can be further manipulated to investigate alternative flows to remedy any emerging flow

problems. FORECASTER employs six variables in addition to activities and tour numbers that will be briefly described, and are as follows:

- Time to forecast
- Accessions
- Tour lengths
- Incumbents
- Transition probabilities
- Billets available.

1. Time to Forecast

The unit of time can be selected to be any time interval such as month, quarter, semi-annual, etc. The other variable values must be in accordance with the time unit chosen. For example, in the SWO model presented here, the time unit is quarters and therefore, accessions and tour lengths are on a quarterly basis as are the other variables.

2. Accessions

Accessions are defined as the number of persons entering the system at the first tour at the beginning of each future time interval. They must be entered for each activity (e.g., zero for no entries in an activity). Accessions, therefore are in the form of a 1 x A vector, where A represents the number of activities. Accessions may also be given as an uneven flow of personnel entering the system. In other words, if accessions are expected to vary from time to time, the model is able to accommodate the uneven input of

personnel into the system. This can be accomplished by placing accessions in a matrix format where rows stand for activities and columns for the number of quarters forecasting into the future. If the user inputs only a 1 x A vector for accessions of personnel, the model will assume constant accessions for as many quarters (or other time intervals) as the user intends.

3. Tour Length

The tour length data is in the form of an A x R matrix, where A is the number of activities and R is the number of tours. Each element in the matrix corresponds to the length of time an officer is assumed to spend in a particular activity and tour in quarters (or other unit of time used). If there are no feasible billets in an activity and tour number, a zero tour length is used for that node.

4. Incumbents

The incumbent input is dimensionally the same as the tour length matrix. Incumbents refer to those officers present in an activity and tour at time zero (i.e., at the present time before forecasting begins). Similar to the tour length matrix, if there are no incumbents for a particular activity and tour number, a zero is used at that node. This may indicate either an infeasible billet type or a feasible one where there happens to be no officers at the present time.

Incumbents in the system may be in various stages of experience or tenure in their current activity and tour

number. "Tenure" here refers to the number of time intervals (e.g., quarters) an individual has spent in his current activity and tour number by the present time (t = 0).

Because officers of varied tenure are typically occupying current billets, incumbents are accommodated in FORECASTER by creating matrices that breakdown the number of personnel in each node according to the tenure in the billet they are in. The number of matrices corresponds to the number of time intervals (i.e., tour length) in each specific node. In each matrix the value at the node represents the number of personnel who share the same amount of tenure. If the incumbent data is presented as only one matrix, FORECASTER assumes a uniform distribution of personnel among the amounts of tenure over the entire tour length at each node.

5. Transition Probabilities

As discussed earlier, the transition probabilities represent the personnel flow through the system. Since there are twelve tours in the SWO model, there are eleven transition probability matrices, where matrix 1 stores the probabilities for going from activities in tour one to activities in tour two; matrix 2 contains probabilities of going from activities in tour two to activities in tour three and so on.

Therefore, in each of these matrices the rows represent the activities an officer is in during one's current tour and the columns represent the activities to which the officer will transfer for the next tour. So, for example, the

third transition probability matrix provides the probabilities associated with transitions from the third tour activities to the fourth tour activities. Therefore, the elements in the matrices are numbers between 0 and 1 inclusive and must sum to no more than 1; with 1 minus the sum representing the probability of separation from the SWO community.

6. Billets Available

The required number of billets to be filled may also be entered by the user. The A x R matrix represents the total number of billets for each activity and tour in the system. These billets could represent "hard" fills (billets that must be filled by specifically designated personnel in the system), "soft" fills (billets that are allocated to the community but not necessarily requiring a specialist from the community) or a combination of the two. The billet numbers are designed to assist in analyzing the distribution of personnel in the system, as will be illustrated in the next chapter.

Table 3.2 summarizes the variable inputs the user may manipulate to analyze the personnel flow through the system.

D. ASSUMPTIONS

Individual community models may have their own set of assumptions that require specification to better understand the model and results. Those assumptions idiosyncratic to the SWO community will be covered in the next chapter.

TABLE 3.2

VARIABLE SUMMARY

VARIABLE	DESCRIPTION	DIMENSIONS
Time to Forecast	Unit of time to forecast distribution of personnel in the system.	Scalar; t
Accessions	Number of personnel entering system per unit time.	Vector; 1 x A Matrix; A x t
Tour length	Duration of tour for a specific tour number and activity.	Matrix; A x R
Incumbents	Number of personnel in tour number and activty at the beginning of forecasting (at time zero).	Matrix; A x R or array; M x A x R
Transition Probabilities	Probability value between 0 and 1 for personnel transiting from one tour to the next, leaving one activity for another.	Array; R-1 x A x A
Billets Available	Number of billets for an activity and tour number that must be filled by personnel ("hard" billets) and billets that could be filled by personnel in the system ("soft" billets).	2 matrices (hard, soft); A x R; each

A = number of activities
R = number of tours
M = Maximum tour length

FORECASTER, as a tool with which to model and conduct analysis, however, has some general assumptions itself, as follows:

- Time between tours (PCS travel and leave time) are not accounted for in the model, since this time is typically quite short and has no impact on the career path of officers.
- Separations from the system may occur during each tour with probability equal to the difference between 1 and the sum of probabilities of transitions from a given activity, although this probability may be effectively zero in some cases.
- Tour lengths are fixed for all officers for a given activity and tour number, for the duration of the forecasting period.
- Accessions are allowed in the first tour only.

E. MODEL RESULTS ANALYSIS

An effective analysis of a policy's impact on personnel flow can be accomplished through investigating the systems ability to successfully accommodate the policy while fulfilling the systems need to distribute personnel properly. This is specifically how FORECASTER measures the effectiveness of personnel flow. Using the billet data input by the user, the model displays the raw number and percentage of both hard and hard plus soft billets filled. Also displayed will be a matrix of values representing the estimated distribution of personnel in the system for the future point in time selected by the user. The total number of personnel in the system and a breakdown of the total number for each activity for the future point in time are also displayed. Through discovering

trends by forecasting, the user is able to better understand and predict future developments concerning potential problems with manpower in the system.

IV. ANALYSIS

A. SWO MODEL

1. Introduction

As discussed in the preceding chapter, the SWO community model is composed of six mutually exclusive activities and twelve tours. The variable inputs and mathematical computations will allow FORECASTER to output the estimated distribution of personnel in the system at some future time and under system conditions established by the user.

The fleet unit and SWO education activities are of particular interest in the SWO community model. The former is clearly the most important activity for obvious reasons: without manned and combat ready ships, the Navy could not properly perform its mission. The latter has been described as the "choke point" for Surface Warfare Officers pursuing a naval career and warrants close examination. The concept that four division officers create one department head is a most vital ratio in the SWO community. Consequently, the Department Head School in Newport, Rhode Island, is always filled to capacity and often backlogged earning its "choke point" name.

With the inception of the DoD Reorganization Act, the joint duty and joint professional military education

activities will obviously receive much greater attention. Where these billets have in the past years been filled by any officer the SWO community could afford to spare from the mainstream of fleet units and supporting shore facilities, now, only quality officers can be sent to fill the joint billets. This newly emerged milestone for flag aspiring, career minded SWO's has undoubtedly impacted the traditional SWO career path.

Keeping in mind the previous discussion concerning the DoD Reorganization Act and the SWO career path, FORECASTER will allow investigation of the policy and its impact on the current SWO community personnel flow.

2. Data and Variables

In order to carry out the analysis, it was first essential to obtain the necessary data to establish the variable inputs for the current personnel in the SWO community. The data obtained for this analysis came from the Surface Warfare Officer Community Manager (OP-130E) and the Defense Manpower Data Center (DMDC) Monterey, California.

The scope of the data for this analysis pertains to male officers possessing designators as follows:

- 1110--active duty, SWO qualified
- 1115--active duty reserve, SWO qualified
- 1160--active duty, SWO in training
- 1165--active duty reserve, SWO in training.

Only officers with the preceding designations of the ranks 01 (Ensign) through 06 (Captain) are considered in this model.

Some difficulty was experienced in gathering the necessary data as the SWO community, composed of over 12,000 officers, does not record or maintain data in the exact format required by FORECASTER, i.e., by activity and tour number. However, a tape of all officers in the Navy, the Officer Master File (OMF), was obtained from Naval Manpower Personnel Command (NMPC) from which using various SAS programs, the data was first narrowed down to officers in the SWO community. Then sufficient data was extracted to gather the necessary inputs for this model.

A review of the actual data used in this analysis can be found in Appendix B. Table 4.1 reviews the specific definition and dimensions of the variable inputs that were utilized by FORECASTER.

3. Assumptions

The general assumptions pertaining to FORECASTER as an analysis and modeling tool were discussed in Chapter III. Each community that is to be modeled is likely to have additional assumptions particular to that community. Assumptions may vary even within one community depending on the purpose of the analysis. Here, in the SWO community model, the additional assumptions made are as follows:

- Personnel entering the system have successfully completed the Surface Warfare Officer School (SWOS) Basic course and their first tour in the system is in a fleet unit as a division officer.

TABLE 4.1

VARIABLE SUMMARY

VARIABLE	DESCRIPTION	DIMENSIONS
Time to Forecast	Unit of time to forecast distribution of personnel in the system; quarterly.	Positive integer; Scalar
Accessions	Number of personnel entering at fleet unit as a division officer per quarter.	Vector; 1 x 6
Tour length	Duration of tour for a specific tour number and activity in quarters.	Matrix; 6 x 12
Incumbents	Number of personnel in tour number and activity at the beginning of forecasting (at time zero).	Matrix; 6 x 12
Transition Probabilities	Probability value between 0 and 1 for personnel transiting from one activity to another while leaving one tour for the next.	Array; 11 x 6 x 6
Billets Available	Number of billets for an activity and tour number that must be filled by personnel ("hard" billets)and billets that could be filled by personnel in the system ("soft" billets).	2 matrices (hard, soft); 6 x 12; each

- After the twelfth tour, all personnel still in the system will leave the system.

- Incumbent tenure is evenly distributed among personnel in all activities and tour numbers. For example, an activity and tour of 6 quarters in length with 60 incumbents will have 10 officers with no tenure (just starting their tour), 10 officers with 1 quarter tenure, 10 officers with 2 quarters tenure, and so forth up to 10 officers with 5 quarters tenure. It is assumed that at the instant of completing quarter 6, personnel transit from their current activity to their next tour and activity or leave the system.

4. Scenario Propositions for Analysis

Using the SWO model, FORECASTER was run for various time intervals into the future for three separate scenarios. The first scenario is a "status quo" scenario for the current personnel flow in the Navy. This will provide the baseline to which the other two proposed scenarios are compared.

The second scenario proposes an established percentage of "quality" post department head, post executive officer and post commanding officer personnel to be sent to joint duty assignments and JPME to effectively fulfill the requirements of the DoD Reorganization Act. The third scenario proposes sending a fixed percentage of personnel from postgraduate education to JPME with a proportion proceeding on to a JDA.

Graphs are offered to facilitate understanding the results obtained from using FORECASTER. A sample "session" with FORECASTER on the IBM 3033 mainframe computer at the Naval Postgraduate School is provided in Appendix C and a user's manual is provided in Appendix D. While the analysis of the DoD Reorganization Act may not be completely

exhaustive, the essence here is to demonstrate the use of FORECASTER as an analytical tool.

B. MODEL RUNS

1. Introduction

The three scenarios introduced in the preceding section are reviewed in Table 4.2 and will now be discussed in detail. Undeniably, the SWO community has the quantity of personnel to be able to fill all of its allotted billets. The difficult task is fulfilling the requirements mandated by the DoD Reorganization Act; specifically, that of placing promotable officers in joint billets while still meeting the requirements of manning and supporting the ships in the fleet.

In the "status quo" scenario, current personnel flow as it presently exists is used to predict the estimated distribution of personnel for the established activities and tour numbers for some time in the future. The purpose here is to provide results with which the two proposed scenarios can be compared. Shortages of personnel filling billets is the true measure of personnel flow effectiveness.

The first proposed scenario, sending a fixed proportion of department heads, post executive officers and post commanding officers to the joint billets, is not meant to freeze an arbitrary percentage of officers to be sent to such billets. The idea here is to pick the top proven

TABLE 4.2

SCENARIO PROPOSAL REVIEW

SCENARIO NAME	DESCRIPTION
1. Status Quo	Provide base line results using current personnel flow in SWO community.
2. Fixed Proportion Proposal	Send post department heads, executive officers and commanding officers to JDA and JPME billets in established proportions.
3. JPME Following Postgraduate Education Proposal	Send fixed percentage of postgraduate personnel to JPME billets and another fixed percentage from JPME to JDA billets. Others will transit to fleet unit activity or SWO education, as appropriate.

TABLE 4.3

INCUMBENT DATA

ACTIVITY	TOURS											
	1	2	3	4	5	6	7	8	9	10	11	12
POSTGRAD EDUC.	0	124	133	12	12	28	8	7	2	0	2	0
JPME	0	0	3	0	2	11	9	12	15	7	4	1
JOINT TOUR	0	1	3	3	3	12	15	36	91	41	39	19
SWO ED	0	24	55	69	15	9	0	0	0	0	0	0
FLEET UNIT	3644	765	168	299	465	253	225	194	313	172	69	46
SHORE DUTY	0	466	530	126	88	119	117	244	428	252	137	83

performers rotating off arduous fleet unit tours and send them to JDA or JPME billets. Obviously, selectees should be the top "one percent" by fitness report standards, who have proven their promotability by their outstanding performance in the most demanding job--a tour at sea in a department head, an executive officer, or a commanding officer billet.

The second proposed scenario, sending personnel to JPME after completing postgraduate education, is also examined since it can be assumed that top performing junior officers are sent to postgraduate billets. However, not all officers leaving postgraduate school will be sent to JPME. Similarly to the fixed proportion proposal, there is a fixed percentage of graduates who transit to JPME, and another fixed percentage that will transit from JPME to a JDA. The need to send only a percentage of postgraduate school graduates is to keep the "choke point" (Department Head School) filled to capacity and the ships at sea manned. This is further discussed in the model results section.

In order not to bias the results, the attrition rate from each tour is held constant when changing from one scenario to another. It would indeed be an easy solution to simply retain more personnel to man the extra billets and assume "quality" personnel were manning the joint and critical sea billets. Also, the same incumbent, accession, and tour length data were used for all three scenarios, to maintain an unbiased and fair

comparison. The only values that were altered when changing scenarios were the transition probabilities.

2. Incumbent, Billet Data and Approximating the Transition Probabilities

The incumbents for the SWO model are shown in Table 4.3. This data was obtained from DMDC, Monterey, and was also instrumental to establish the status quo transition probabilities.

Computing the rate at which personnel leave an activity and tour number (by dividing the number of incumbents by the tour length) as well as the rate at which personnel leave the next tour's activities, it is possible to obtain transition probabilities that are reasonably accurate. This also necessitates having a notion of what activities are feasible to advance to on the next tour. This may be based on the SWO Professional Development Path (Chapter II, Fig. 2.1).

For example, in tour number two, the fleet unit activity, personnel can proceed from there to postgraduate education, another fleet unit, or shore, when progressing to tour number three or else separate from the system. Based on the 765 incumbents at the second tour fleet unit activity, which is of six quarter duration, every quarter approximately 127 (765 divided by 6) officers must rotate from the activity. Checking the possible activities in tour number three to which personnel can proceed and dividing their incumbents by the respective tour length, an approximate rate at which personnel leave these possible destination activities is also computed.

These departure rates from the various activities of tour number three are thus considered as approximate numbers of transferees from tour number two to tour number three. For example, for shore activity in tour number three (530 incumbents, eight quarter tour length) the departure rate is 66. Thus, in order not to overflow or shortchange the shore activity the number of transferees to it may be assumed to be approximately 66. Then the probability of transition from fleet unit in tour number two to shore in tour number three is approximately .52 (66 divided by 127). This computation presented here is employed to obtain a "ballpark" figure on which a user may build. However, one of the strengths of this model is the option given the user to manipulate the various transition probability values and observing the resultant changes in forecasted officer distributions at future times.

The "hard" billet data is reviewed in Table 4.4. This data received from OP130E1 was modified through phone conversations with personnel at OP130E1 and Officer Allocation and Distributable manning Projection Branch. The data was formatted by activity and rank, not tour number as FORECASTER requires. To analyze and compare the results of the model runs, assumptions were made concerning the billet data in terms of the tour numbers and activities spanned by specific ranks. This will be further discussed later in this chapter.

Also, "soft" billet (designated 1000/1050) data in the same format as the hard billet data was received from OP130E1. However, soft billets are flexible in that they are often

TABLE 4.4

HARD BILLET DATA

	RANK						
ACTIVITY	06	05	04	03	02	01	TOTAL
PG EDUC	0000	0000	0042	0102	0000	0000	0144
JPME	0000	0042	0072	0000	0000	0000	0114
JOINT TOUR	0093	0191	0097	0000	0000	0000	0381
SWO EDUC	0000	0000	0000	0425	0025	0000	0450
FLEET UNIT	0147	0492	0891	1298	1660	1570	6058
SHORE	0138	0323	0512	0606	0045	0027	1651
TOTAL	0378	1048	1614	2329	1730	1597	8798

traded with and filled by members of other communities. Therefore, they are not directly considered in this analysis. In some activities, the results will show an excess of 100 percent more personnel than hard billets and it should be understood that such excess personnel would be assigned to soft billets. Thus, it is more appropriate to consider only hard billets in the analysis to clearly show the personnel flow effect in each scenario.

3. Analysis Methodology

In order to establish trends and better focus the analysis, forecasts are conducted in three quarter increments, ranging from six quarters through twenty-four quarters. Six quarters constitute an adequate time into the future to forecast, allowing personnel flow to generate and observe changes in the distribution of personnel in the system. At the other extreme, twenty-four quarters is considered adequate time into the future to recognize and understand the trend of personnel flow for each scenario being studied.

The focus of this analysis is on the billets filled in the JPME, joint tour, fleet unit and shore activities. Postgraduate education and SWO education activities will not be discussed in the analysis since the DoD Reorganization Act does not directly affect them. The impact of the Joint Reorganization Act is shown to occur after the sixth tour. All SWO's go to Department Head School and most go to a postgraduate school before their sixth tour, and are

therefore not affected. SWO education is briefly discussed in the second proposed scenario since there is some effect on the personnel flow to Department Head School.

The distribution of hard billet data for ranks 04, 05 and 06 by the specific activities and tour numbers for purposes of the analysis presented here is displayed in Table 4.5. This breakdown should not imply that the rank of an officer is constrained within the tour numbers specified. Actually, it is feasible that the ranks for officers are spread over an even larger range of tour numbers. However, the breakdown is an interpretation of the rank/tour number distribution and is intended to establish a means by which the scenarios can be compared with one another on a common scale.

5. Model Results

a. Overview

The results for the three scenarios are now discussed. In each case, the transitions among activities when proceeding from one tour to the next, are graphically displayed in the context of the SWO community model. Results from the model runs are graphed for the quarters forecasted and the percent of hard billets filled.

The FORECASTER results represent an estimated distribution of personnel in the SWO community as it has been defined for this analysis. Results that show an increasing trend, or positively sloped curve, are the result of a rate

TABLE 4.5

RANK/BILLET DISTRIBUTION
BY TOUR NUMBER

ACTIVITY & SCENARIO		LCDR (04)	CDR (05)	CAPT (06)
JPME	1	6,7,8	9,10,11,12	-------
	2	6,7,8	9,10,11,12	
	3	3,4,5,6,7,8	9,10,11,12	
Joint Tour	1	6,7	8,9,10	11,12
	2	6,7	8,9,10	11,12
	3	6,7	8,9,10	11,12
Fleet Unit	1	5,6,7	8,9,10	11,12
	2	5,6,7	8,9,10	11,12
	3	5,6,7	8,9,10	11,12
Shore	1	5,6,7,8	9,10	11,12
	2	5,6,7,8	9,10	11,12
	3	5,6,7,8	9,10	11,12

1 - Status Quo
2 - Fixed Proportion
3 - JPME Following PG Education

of personnel entering the activity that exceeds the rate of personnel leaving the activity. A decline in the percent fill is the result the of the opposite occurrence taking place. Erratic movements in the percent fill indicate uneven flow of personnel as the system strives to reach equilibrium. FORECASTER, being a transient model, displays all of these occasionally only temporary trends. Noting these trends should contribute to a better understanding of the personnel flow within the community.

b. Status Quo Scenario

The status quo scenario assumes the current flow in the SWO community does not change from its present course. Figure 3.1 in Chapter III graphically shows the flow as modeled in FORECASTER. The results obtained here are the "base case" upon which the other two scenarios are compared. Table 4.5 should be consulted in order to review the breakdown of tour numbers and their relationship to rank.

For JPME in the status quo environment, the results are displayed in Figure 4.1. For tour numbers six, seven, and eight, the status quo shows a small upward slope with the percent fill moving from 41.7% to 54.2%. The later tour numbers (nine through twelve) show an initial decline in billet fills with a convex curve (where the minimum fill is 31% during quarters nine and twelve) which then increases after quarter twelve to a 38.1% fill at quarter 24.

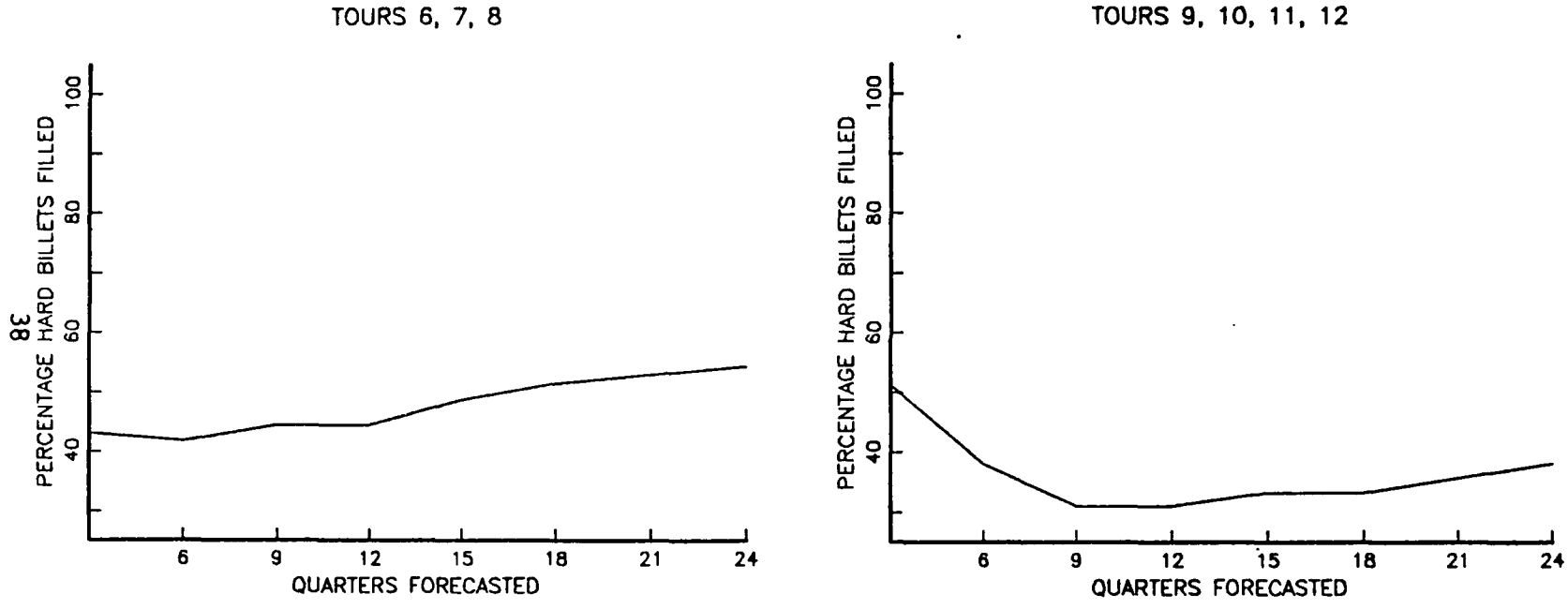


Figure 4.1 JPME Activity Results: Status Quo Scenario

The joint tour activity results are shown in Figure 4.2. The curve for tours six and seven indicate an increasing billet fill percentage while tour numbers eight, nine, and ten indicate a downward slope then an increase. Tours eleven and twelve show an erratic trend, peaking at 73.1% billet fill.

In the fleet unit activity, Figure 4.3, the early tour numbers, five, six, and seven, show an increasing trend. The middle tours, eight and nine, display an erratic behavior of increase, decrease and then increase again. The last tour numbers, eleven and twelve, show an increasing trend except after quarter eighteen, at a 173.5%, when the billet fill slowly descends. The fleet unit, being the SWO community's most vital activity, is unsurprisingly well above 100% in its fill of hard billets. While the distribution of hard billets by rank over the tour numbers is not exact, it must be recalled that to compare the other two proposed scenarios to the base case presented here, assumptions had to be made and the billets had to be distributed consistently among the three scenarios.

Finally, the shore billets displayed in Figure 4.4 show increasing trends for the early tour numbers (five through eight) and a decreasing trend followed by a slightly increasing slope for tour numbers nine and ten. In tours eleven and twelve, the trend is first steady then one of a large rise between quarters nine and twelve, followed by

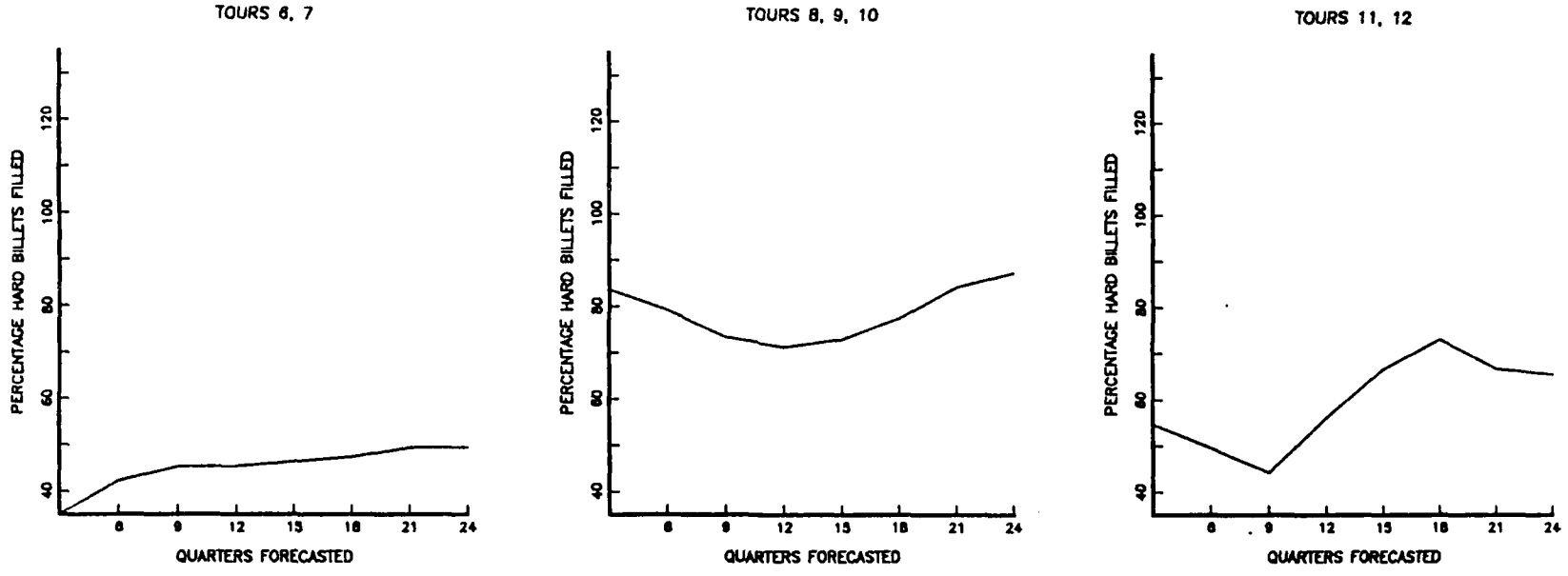


Figure 4.2 Joint Duty Activity Results: Status Quo Scenario

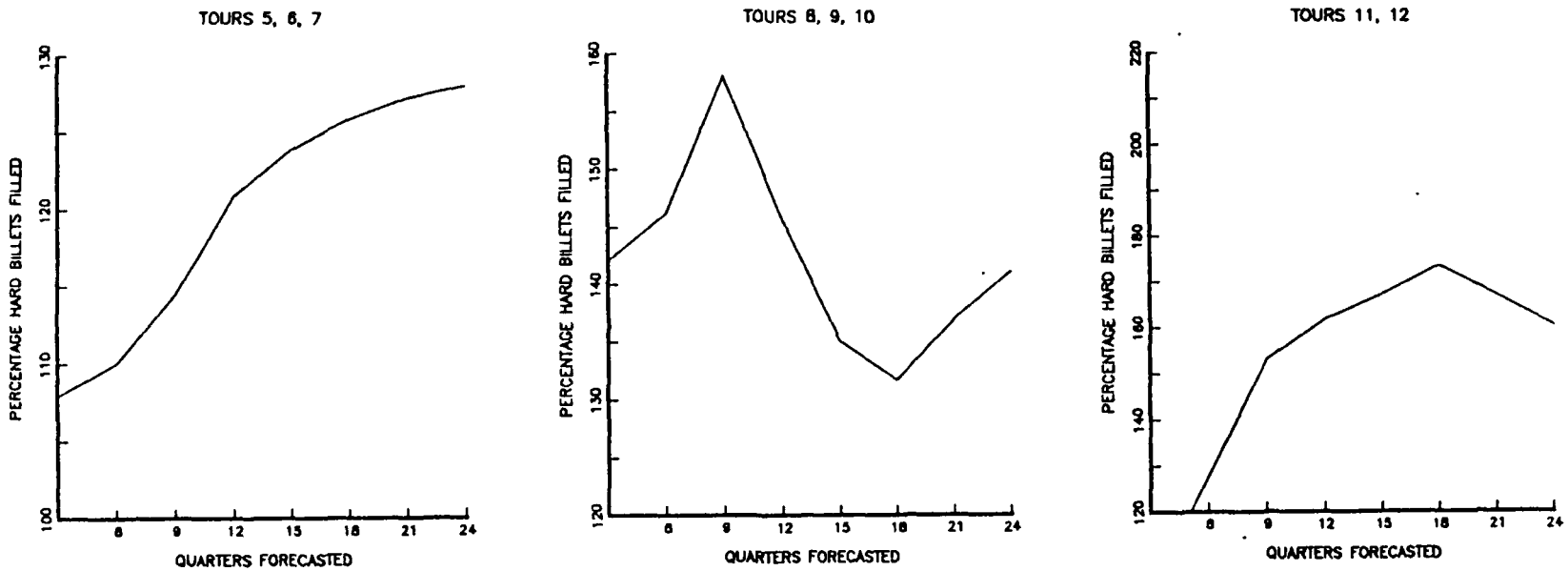


Figure 4.3 Fleet Unit Activity: Status Quo Scenario

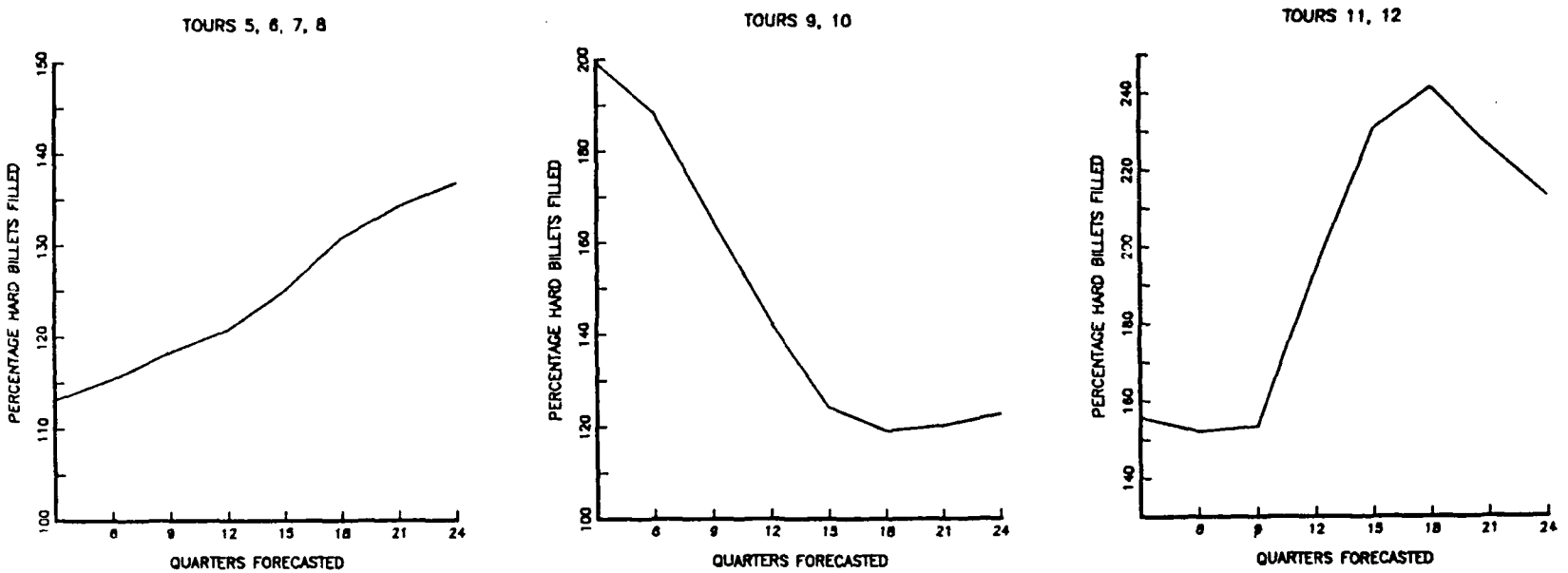


Figure 4.4 Shore Activity Results: Status Quo Scenario

another increase and finally after quarter eighteen, a decrease. These erratic trends represent transient personnel flow moving towards equilibrium.

These results obtained from the status quo scenario were mainly intended to provide the means by which the effect of the two proposed scenarios can be analyzed. Therefore, to better understand and interpret the impact of the proposed scenarios, the percent fill under each proposed scenario will be plotted against the percent fills of the status quo scenario.

c. Scenario 2: Fixed Proportion Proposal Scenario

In this proposed scenario, the transition probabilities for post department head, executive officers and commanding officers is established at a fixed rate slightly higher than the rate in the status quo scenario. Figure 4.5 displays the transitions that are directly affected by this proposal with dashed lines and Table 4.6 compares the transition probability values for the status quo scenario to those of the fixed proportion proposal.

The probabilities of transition from JPME to a joint tour or another activity are at the same level in both scenarios. However, in transiting from tour eleven to twelve for the fixed proportion proposal, the chance of proceeding from JPME to a JDA is fixed at .5 to maintain the requirements mandated by the Joint Reorganization Act.

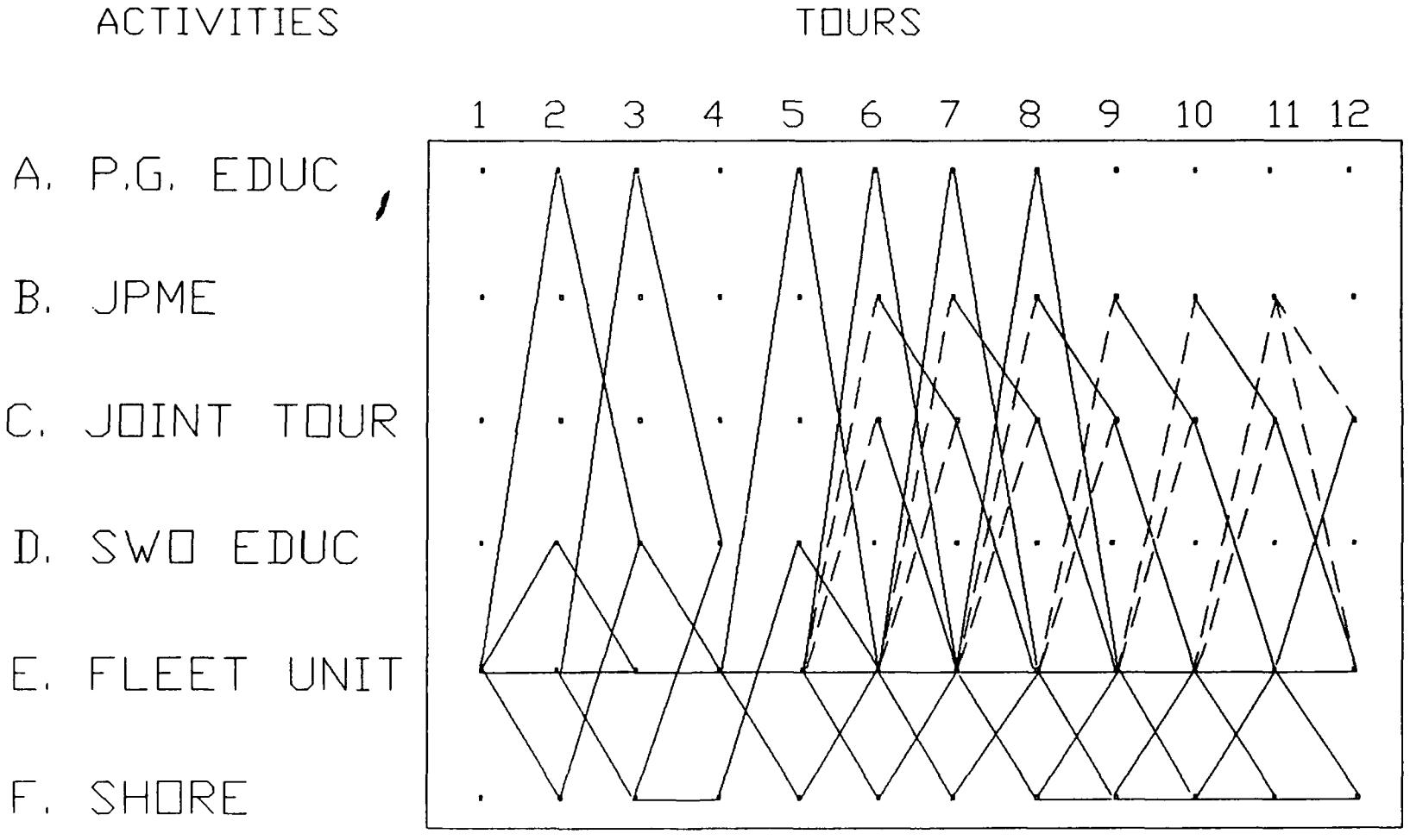


Figure 4.5 Proposed Scenario 1: Fixed Proportion Proposal Scenario

TABLE 4.6

TRANSITION PROBABILITY VALUE COMPARISONS FOR STATUS QUO SCENARIO VS FIXED PROPORTION PROPOSAL

TRANSITION PROBABILITIES FROM TOUR	FROM ACTIVITY	TO ACTIVITY	PROBABILITY VALUES	
			STATUS QUO	JPME FOLLOWING PG EDUC PROPOSAL
5 to 6	Fleet Unit Fleet Unit	JPME Joint Tour	.07 .02	.10 .06
6 to 7	Fleet Unit Fleet Unit	JPME Joint Tour	.10 .04	.15 .10
7 to 8	Fleet Unit Fleet Unit	JPME Joint Tour	.15 .05	.20 .10
8 to 9	Fleet Unit	JPME	.15	.15
9 to 10	Fleet Unit Fleet Unit	JPME Joint Tour	.06 .02	.15 .12
10 to 11	Fleet Unit Fleet Unit	JPME Joint Tour	0 .10	.15 .15
11 to 12	Fleet Unit Fleet Unit	JPME Joint Tour	0 .20	.10 .20
	JPME	Joint Tour	0	.50
	JPME	Fleet Unit	0	.50

In comparing the two scenarios, the JPME activity results in Figure 4.6 are first discussed. The effects are as anticipated with an 18-20% more hard billet fill for tours six, seven and eight throughout the forecasted periods. In the later tour numbers (nine through twelve), the increase in billet fills is more drastic. As much as 50% more billets are filled with the smallest percent increase of 33% in quarter nine.

As for joint duty, the results are very similar as seen in Figure 4.7. For tours six and seven, the hard billets filled increased steadily throughout the forecasted periods topping 100% at quarter twelve. The mid tour (eight, nine, and ten) results show a similar trend but not at such a large percentage increase as the earlier tours. This can be attributed to the larger probability changes in the earlier quarters. In the later tour numbers (eleven and twelve), the increase is similar to that of the earlier tours in approximately the same magnitude. This is a direct result of sending officers in their later tours to receive JPME credit with the hope of filling a joint billet.

In the all important fleet unit activity, as displayed in Figure 4.8, since more personnel are being placed in the joint duty and JPME billets, the trend for billet fills for the early tours and the middle tours slightly lag the status quo scenario. In tours eleven and twelve though, the billet fills exceed the status quo scenario while mirroring

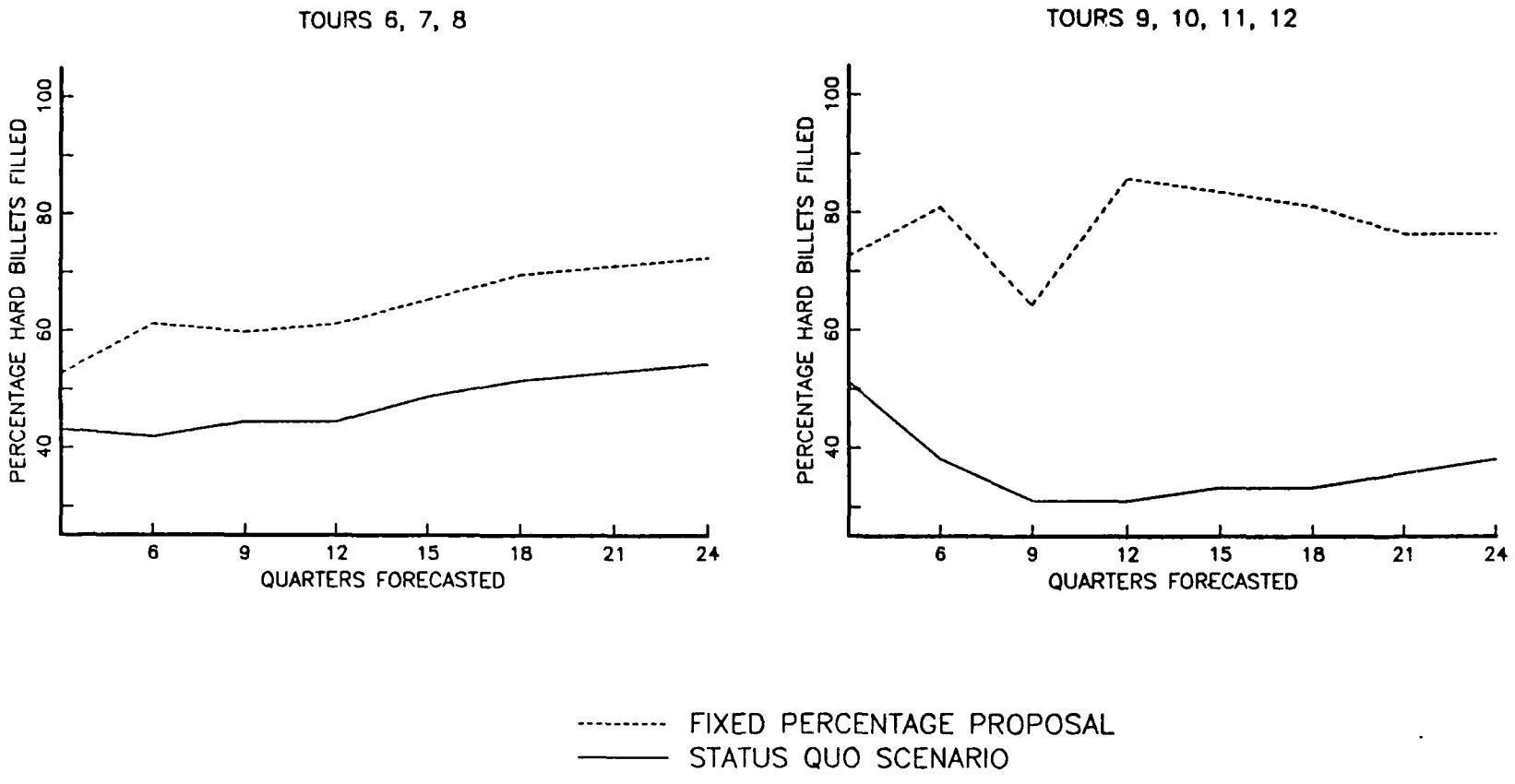


Figure 4.6 JPME Activity Results: Status Quo Scenario vs Fixed Proportion Proposal

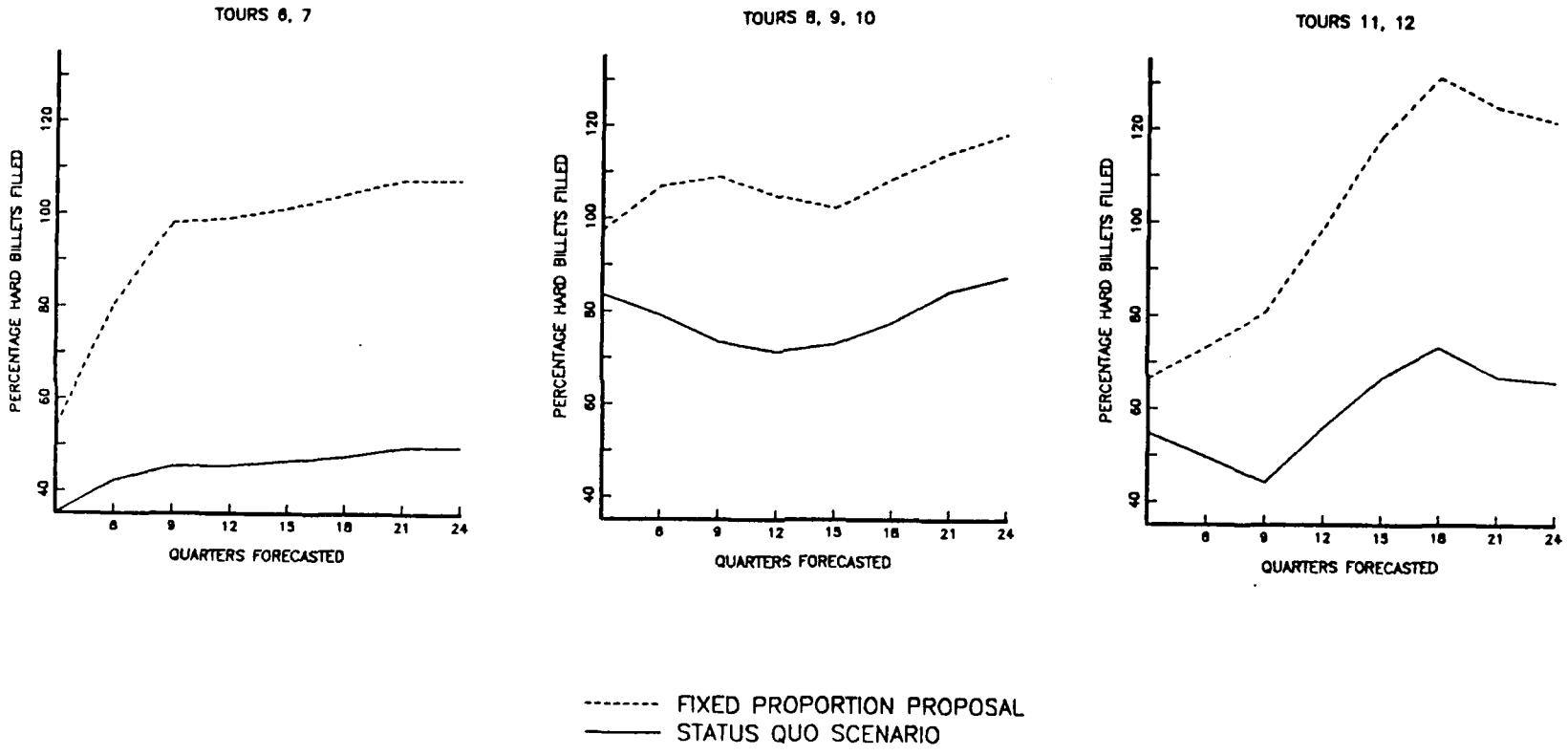


Figure 4.7 Joint Duty Activity Results: Status Quo Scenario vs Fixed Proportion Proposal

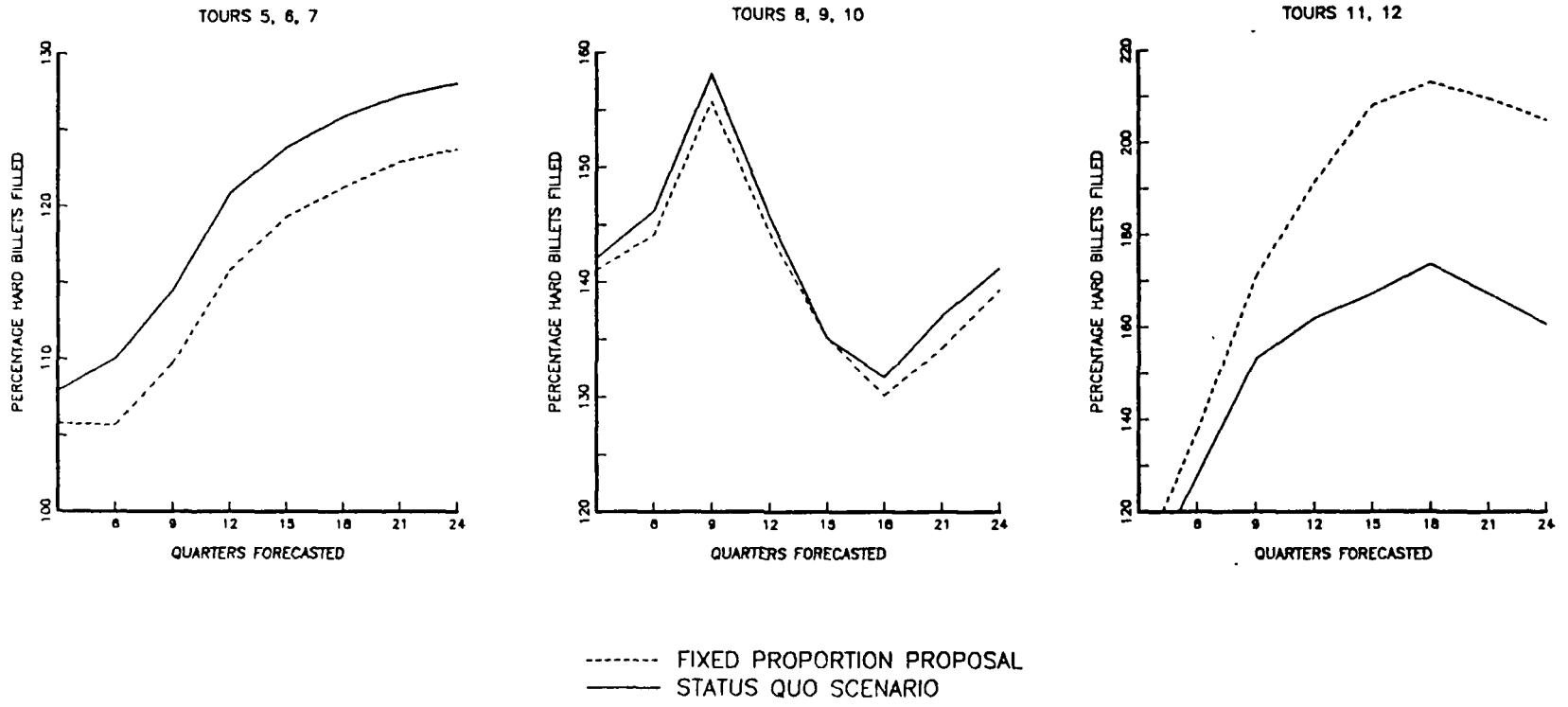


Figure 4.8 Fleet Unit Activity Results: Status Quo Scenario vs Fixed Proportion Proposal

their somewhat erratic trend. This happens apparently because personnel being sent to joint duty in their early tours, can be expected to have their fleet unit tours later than under the status quo scenario. Therefore, officers going to major command or senior afloat staff billets will be getting to those assignments later in their career. The reward of joint duty credit as a prerequisite for flag promotion and insurance of promotability is achieved while the opportunity for senior fleet unit billets is delayed.

The fixed proportion proposal for the shore activity displays the same trends as the status quo scenario but to varying degrees. As shown in Figure 4.9, in the early tour numbers (five through eight) the percent of billets filled lags the status quo by scenario by a maximum of 15%. This was expected since the personnel being sent to these JDA and JPME billets are being sent at the expense of sending the officers to shore billets. The percentage of hard billets filled remain high though because similarly to the fleet units, the SWO community is overfilling the shore billets as well. Tour numbers nine and ten reflect the same trend as the lower tour numbers, except here the lag behind the status quo scenario results is a maximum gap of 13% in billet fill. Finally, in the later tour numbers (eleven and twelve), the status quo trend is again mirrored but with a larger gap. The largest gap occurs at forecasted quarter 15 where the spread between the two scenarios is 51%. This large gap occurs

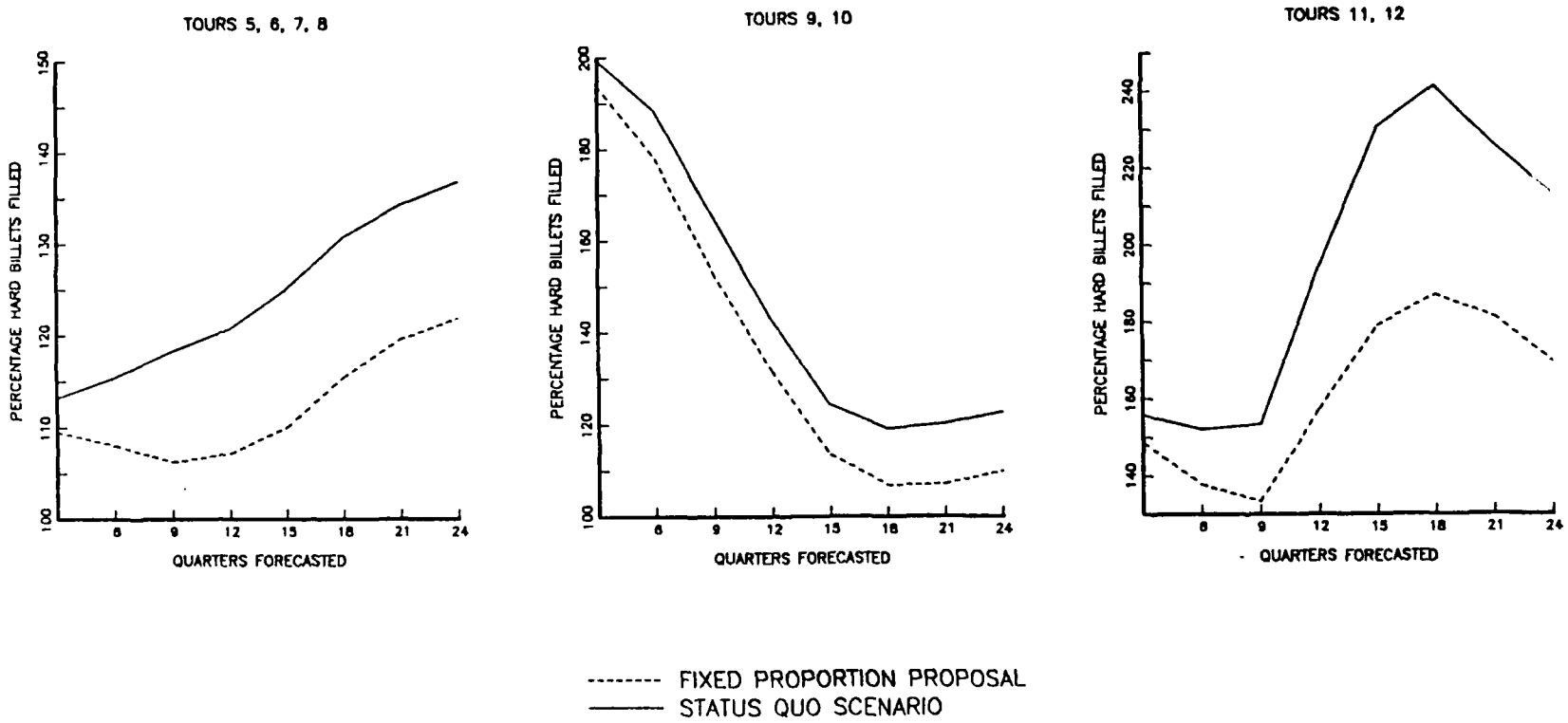


Figure 4.9 Shore Activity Results: Status Quo Scenario vs Fixed Proportion Proposal

because instead of sending the senior officers to the shore billets, they are sent to the joint duty and joint education activities. If more tour numbers were added to the SWO community model, probably the shore billet for the fixed proportion proposal would eventually equal and possibly exceed the status quo hard billet fills.

The results here illustrate that the SWO community can meet the requirements of the DoD Reorganization Act through the fixed proportion scenario without degrading the manning and readiness of our naval ships. The JPME shortage, while still present, is not nearly as bad as that permitted by the status quo scenario. The JPME billets, while obviously not considered as vital to fill as the fleet unit billets, are required for JSO selection and they do help prepare officers for their joint assignments. The second proposal will look at an alternative personnel flow to fill those JPME billets and without placing the fleet in "harms way" from a human resources point of view.

d. Scenario 3: JPME Following Postgraduate Education Proposal Scenario

The deviation from the status quo personnel flow that this proposed scenario represents can be seen in Figure 4.10 in the form of dashed lines. As was previously mentioned, only a fixed percentage of graduates leaving postgraduate school goes on to JPME and then another fixed percentage transits from JPME to joint duty. Those who do not

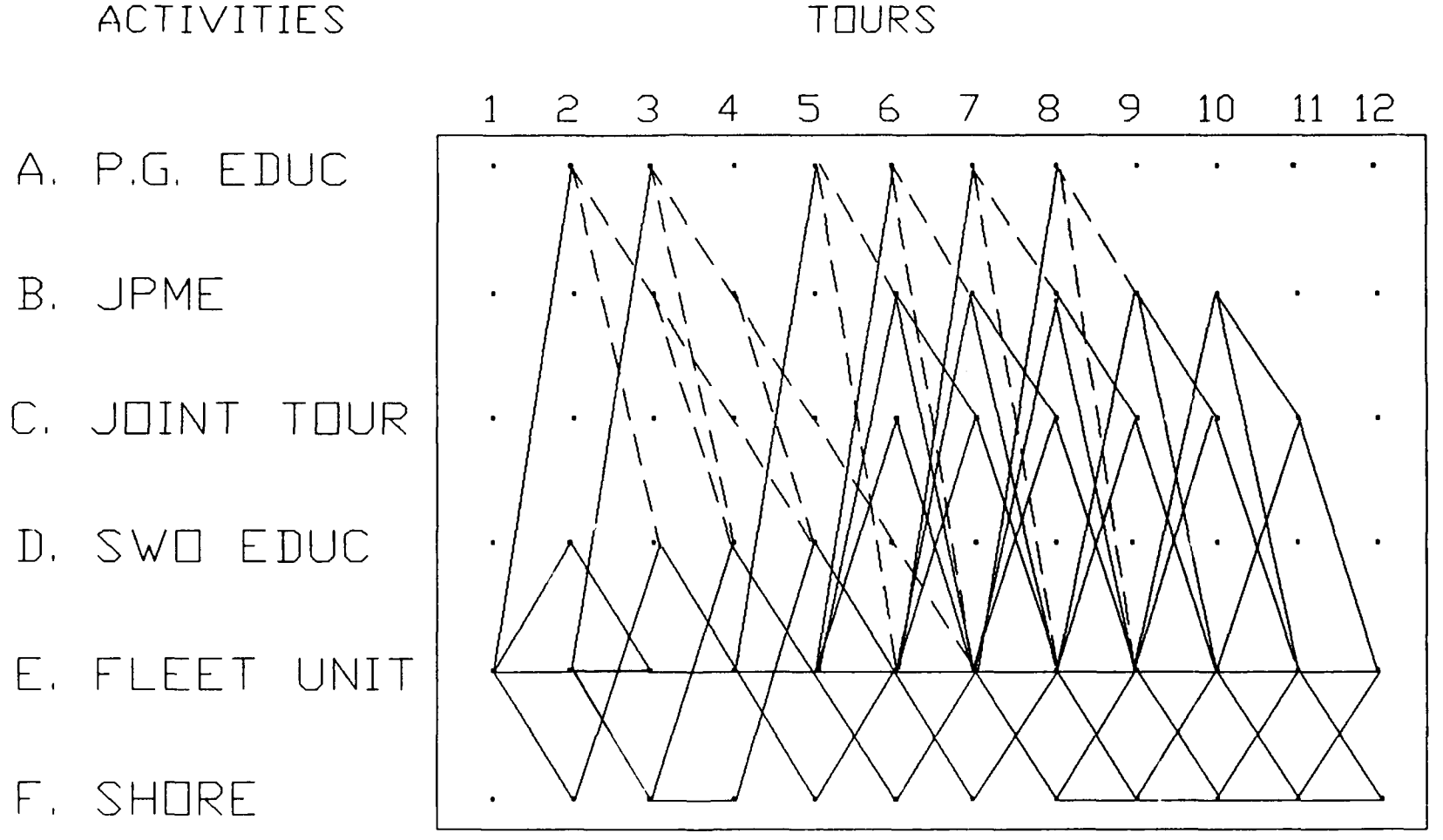


Figure 4.10 Proposed Scenario 2: JPME Following Postgraduate Education Scenario

go on to JPME and/or JDA will go to SWO education or fleet unit as appropriate. The fixed transition probabilities for proceeding from postgraduate to JPME are shown in Table 4.7.

Figure 4.11 graphically represents the results obtained for JPME under this proposed scenario. As expected, the JPME billet fills for tour numbers six, seven and eight are approximately 50% above the status quo scenario. The billets exceed the 100% fill level for these lower tour numbers beginning at quarter eighteen. An increasing trend is observed throughout the forecasting period. In the later tours (nine, ten, eleven, and twelve), the percentage of personnel going to JPME remains about 3 to 5% above the status quo. This small impact is seen here since only a very few officers proceed on to postgraduate education that late in their careers. Also, with the officers going to JPME and JDA during the earlier tours after postgraduate school, there are more officers in the fleet units during their middle tours. This increase in billet fills for the fleet unit activity allows more officers to transit from the fleet units to JPME and JDA thereby increasing the joint billet fills in the middle tours.

Joint duty activity results are displayed in Figure 4.12. In the early tour numbers (six and seven), the joint duty assignment fills are getting larger as the forecasting period increases. A gap of almost 60% compared

TABLE 4.7

TRANSITION PROBABILITY VALUE COMPARISONS FOR STATUS QUO VS JPME FOLLOWING POSTGRADUATE EDUCATION

TRANSITIONS PROBABILITIES FROM TOUR...	FROM ACTIVITY	TO ACTIVITY	PROBABILITY VALUES	
			STATUS QUO	JPME FOLLOWING PG EDUC PROPOSAL
2 to 3	PG Educ	JPME	0	.4
	PG Educ	SWO Educ	1	.6
3 to 4	PG Educ	JPME	0	.4
	PG Educ	SWO Educ	1	.6
	JPME	Joint Tour	0	.5
	JPME	SWO Educ	0	.5
4 to 5	JPME	SWO Educ	0	.5
	JPME	Joint Tour	0	.5
	Joint Tour	SWO Educ	0	1
5 to 6	PG Educ	JPME	0	.5
	PG Educ	Fleet Unit	1	.5
	Joint Tour	SWO Educ	0	1
6 to 7	PG Educ	JPME	0	.5
	PG Educ	Fleet Unit	1	.5
	SWO Educ	Fleet Unit	0	1
7 to 8	PG Educ	JPME	0	.5
	PG Educ	Fleet Unit	1	.5
8 to 9	PG Educ	JPME	0	.5
	PG Educ	Fleet Unit	1	.5

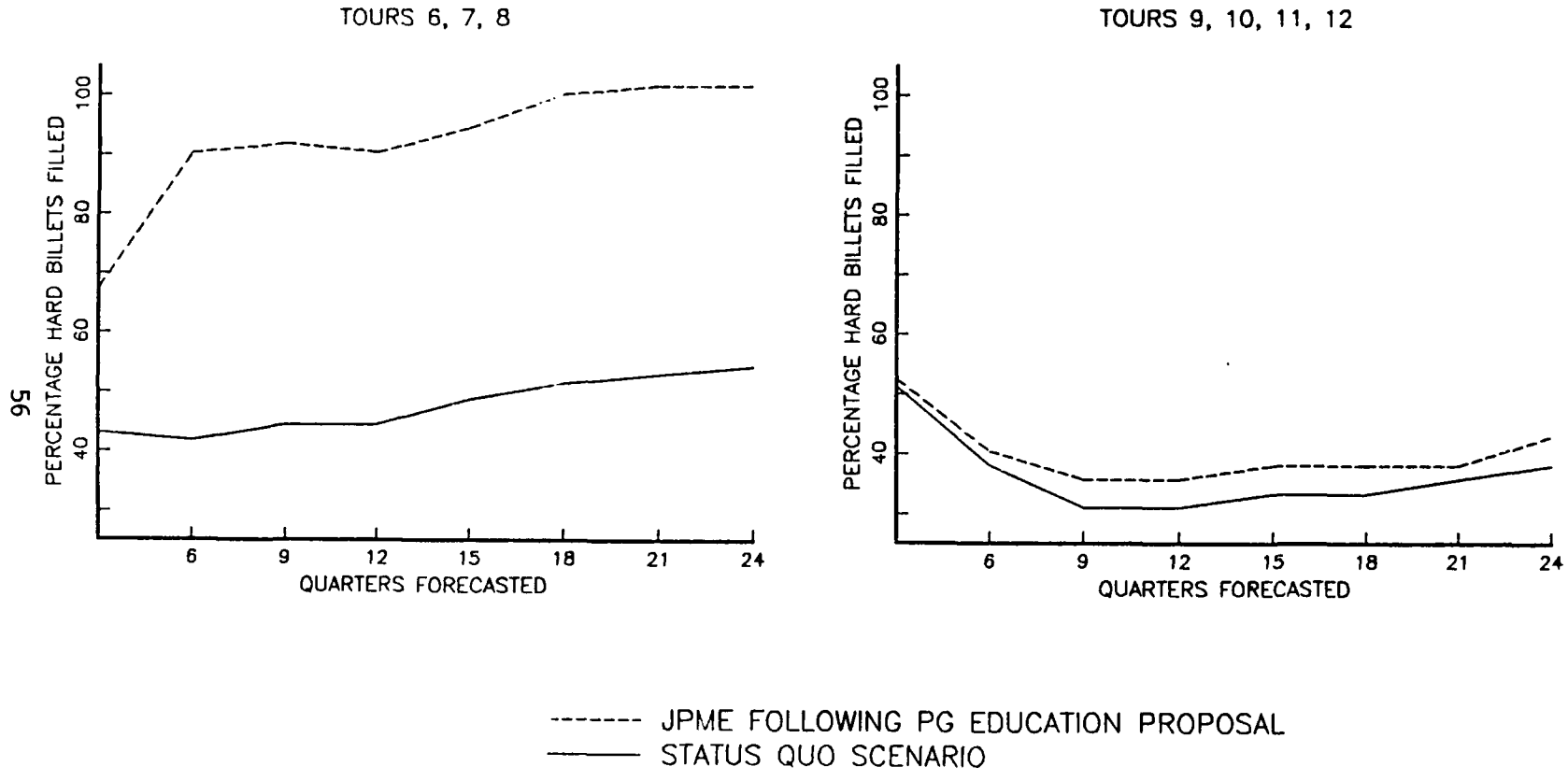


Figure 4.11 JPME Activity Results: Status Quo vs JPME Following PG Education Proposal

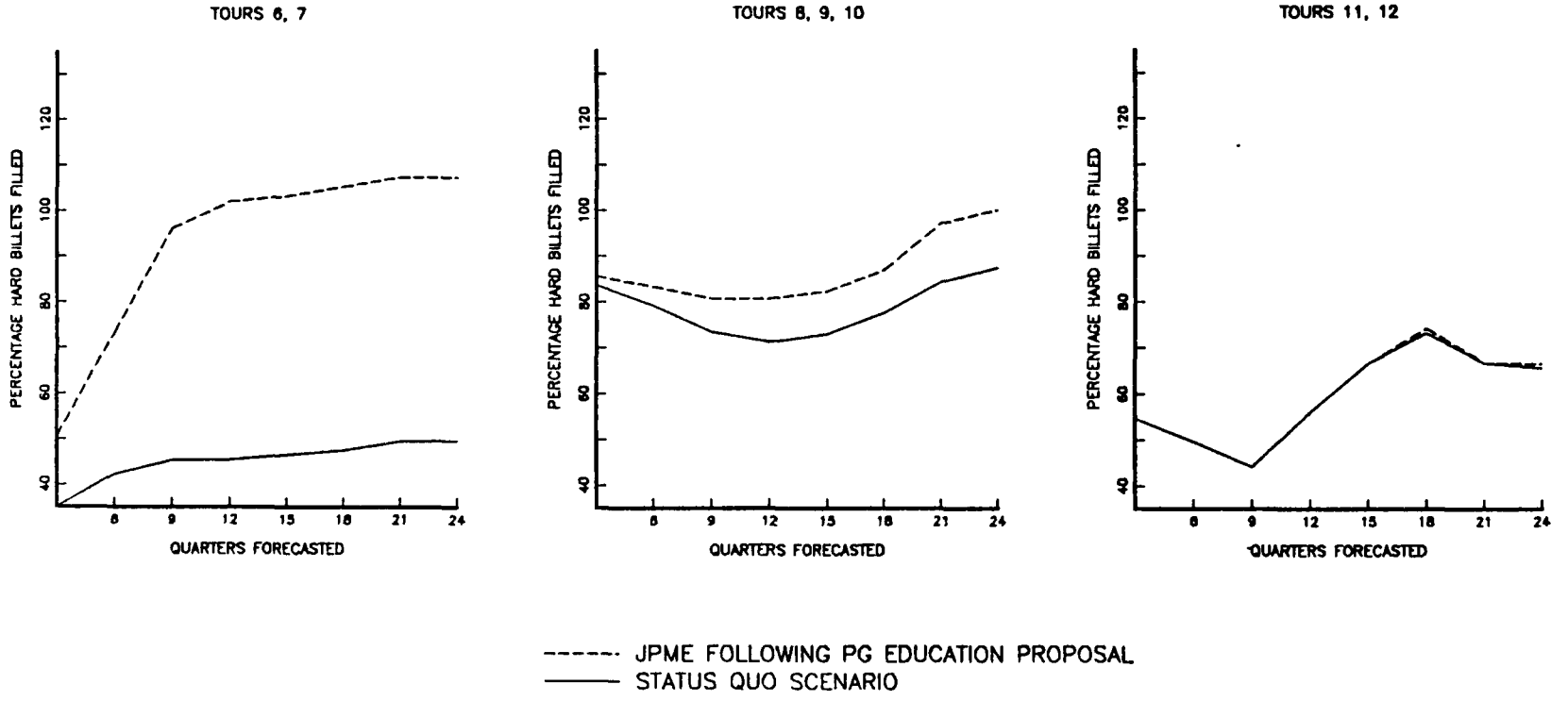


Figure 4.12 Joint Duty Activity Results: Status Quo Scenario vs JPME Following PG Education Proposal

with the status quo scenario is achieved by quarter twenty-four, whereas at quarter six the gap is only 23%. In the middle tour numbers (eight, nine, and ten), the joint duty fill percentage increases also from a gap of 4% at quarter six to a gap of 13% at quarter twenty-four. The joint duty billet fills for the senior tour numbers (eleven and twelve) stays almost exactly the same as under the status quo scenario, since most of the effect occurs in the early tour numbers.

The fleet unit activity results for this scenario can be found in the Figure 4.13. For tour numbers five, six and seven, the fleet unit billet fills for this proposal show a slight 4% lag in comparison to the status quo scenario. This is attributed to the proposal of sending some SWO's to JPME instead of Department Head School immediately upon graduation. With this proposal, some SWO's could find themselves in Department Head School as late as their sixth tour. While there are numerous advantages and disadvantages to this predicament, the major disadvantage is that it would probably put a bright promotable officer behind his peers in his professional career development. On the other hand, the officer will have already received JPME and JDA credit and possible selection as a JSO. It is obvious that this kind of path is not for every officer and those chosen must be carefully selected.

The middle tour numbers (eight, nine, and ten) in the fleet unit show a slightly larger billet fill, ranging

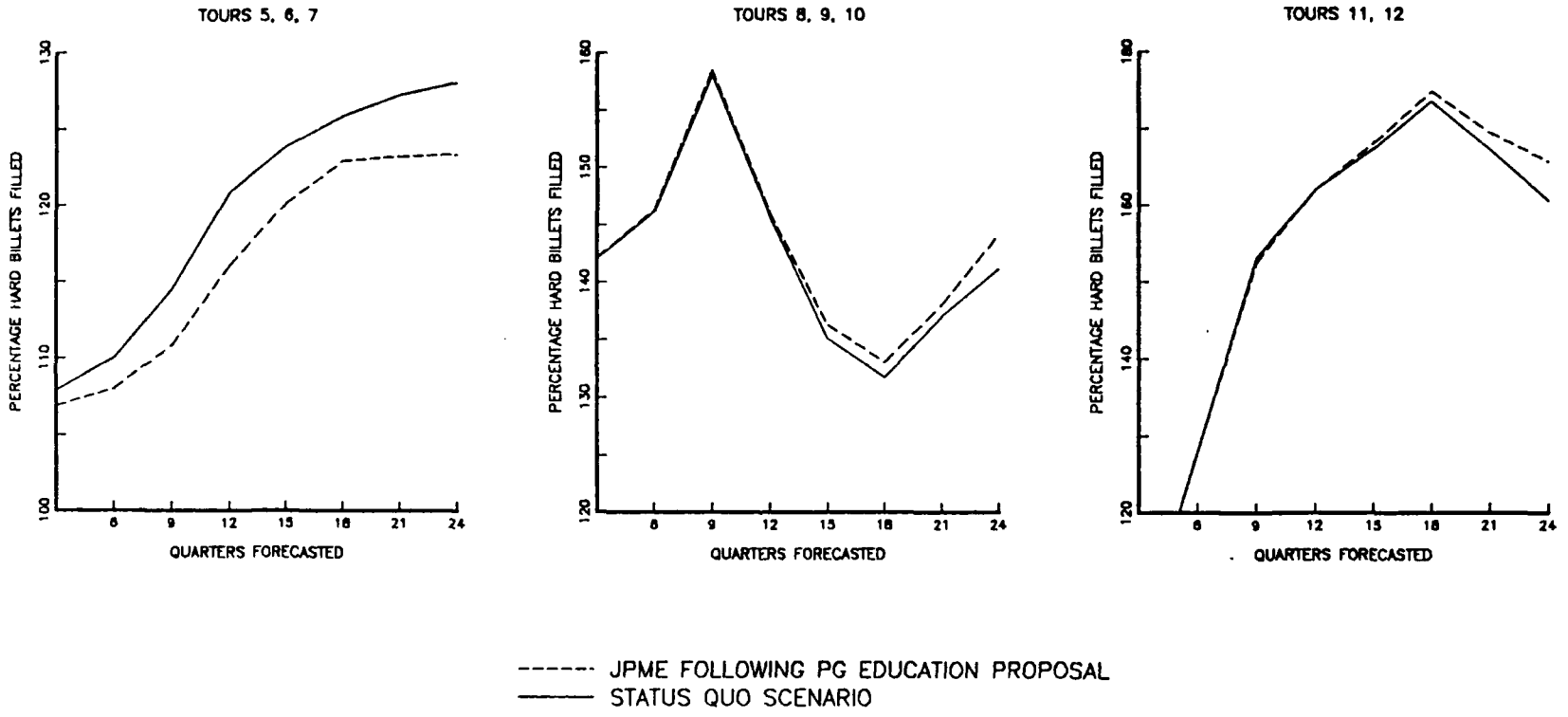


Figure 4.13 Fleet Unit Activity Results: Status Quo Scenario vs JPME Following PG Education Proposal

between 1 and 3%. As mentioned earlier, this is due to officers arriving to the fleet units later in their career if they indeed went from postgraduate school to JPME and then, possibly even to a JDA. Tour numbers eleven and twelve are almost exactly in line with the status quo scenario as was the case with the joint duty activity, except beyond quarter fifteen when the billet fill percentage exceeds the status quo scenario by as much as 5.1% at quarter twenty-four.

The shore activity is only slightly affected by this scenario as shown in Figure 4.14. The early tour numbers (five through eight) show larger gaps as the number of quarters is increased. The largest gap is 7% at quarter twenty-one. In the middle tour numbers (nine and ten), the billets filled are almost exactly the same. In the later tour numbers (eleven and twelve), the results are the same through twelve quarters of forecasting after which the proposed scenario increases its billet fill percentage by 6% at quarter twenty-four.

The JPME following postgraduate education appears to be a worthwhile venture in filling JPME and JDA billets while maintaining fleet readiness. The Department Head School "choke point," which is seemingly always backlogged, allows officers the opportunity to extend two extra quarters and attend a JPME course allowing them the opportunity for better joint awareness.

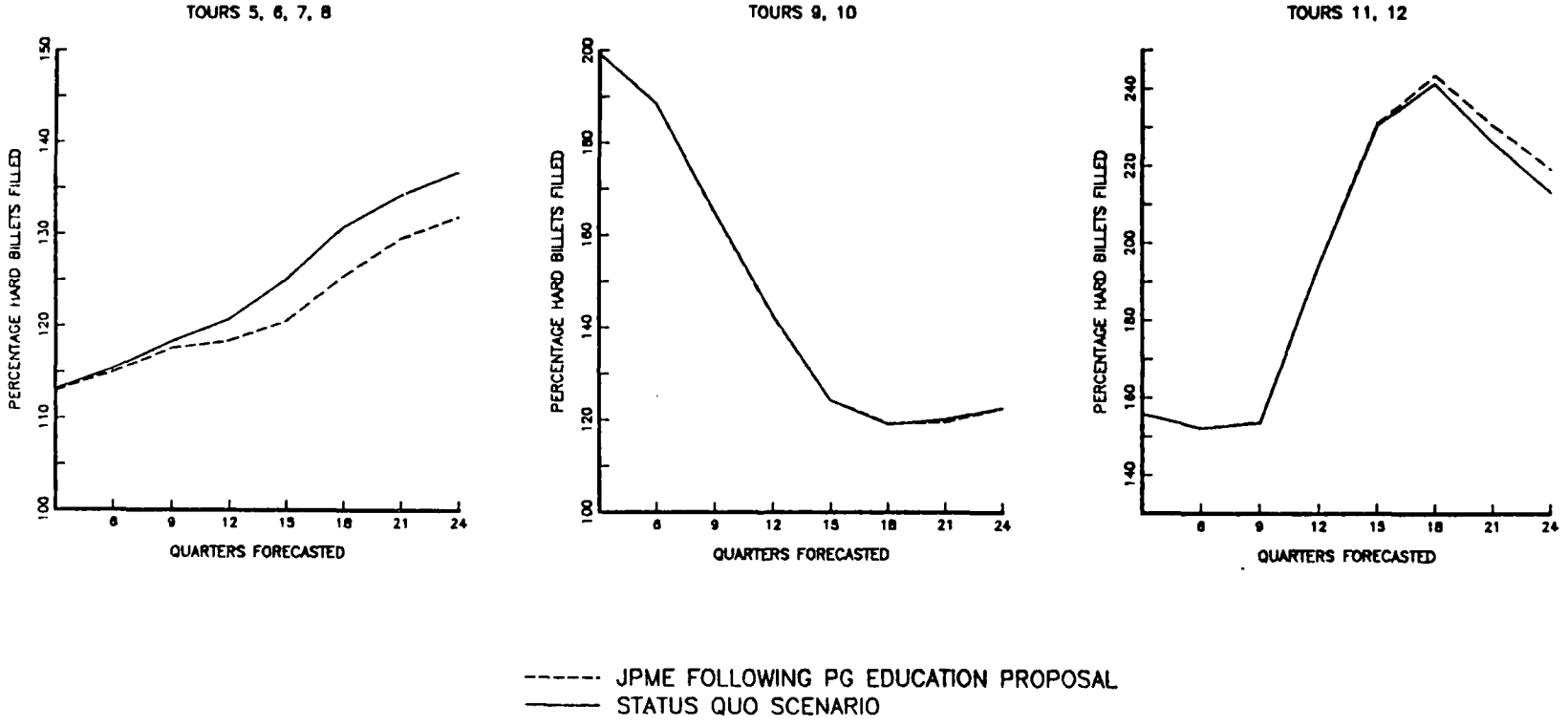


Figure 4.14 Shore Activity Results: Status Quo Scenario vs JPME Following PG Education Proposal

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The purpose of this thesis was to introduce the user-interactive personnel flow model, FORECASTER, and demonstrate its usefulness by analyzing the impact of the Goldwater-Nichols Department of Defense Reorganization Act on personnel flow within the Surface Warfare Officer community. Analysis was conducted by first modeling a status quo or current flow scenario. Forecasting was done for several quarters into the future at incremented levels. These results were then compared to two proposed scenarios described as follows:

- A fixed percentage proposal where a fixed percentage of post department heads, executive officers and commanding officers are sent to JDA and JPME billets.
- JPME following postgraduate education proposal where a fixed percentage of postgraduate education students are sent to receive JPME and another established percentage of JPME graduates move into JDA's.

In the analysis of the scenarios, the focus was on the ability to fill JPME, joint duty, fleet unit and shore billets.

B. CONCLUSIONS

The two proposed scenarios achieved the objective of filling more joint duty and JPME billets while maintaining adequate quantity and quality of officers to man the fleet units. The fixed proportion scenario achieved up to a 60%

increase in some joint duty and JPME billets over the status quo scenario. The cost for this increase in these critical career enhancing billets was a decrease in shore billets filled. The fleet units were decreased slightly in the early tour numbers but were in excess of the status quo in the later tours reflecting the deferment of officers rotating from joint billets back to fleet units at these later tours in their careers.

In the second proposed scenario of JPME following postgraduate education, again billets filled in the joint duty and JPME activities exceeded those filled by the status quo scenario. The critical fleet units were mildly affected with a very slight lag behind the status quo scenario in early tours then a slight increase above the status quo in the middle tours. The later tours were unaffected by this scenario. The slight lag and increase is attributed to the delaying of going to Department Head School after some officers complete their postgraduate education and transfer to JPME. Overall the effect was negligible on the critical fleet units.

It appears that the current SWO personnel flow cannot successfully meet all the requirements mandated by the Joint Reorganization Act. Possible shortages in the critical fleet unit billets can be overcome by establishing fixed percentage transitions for personnel rotating from successful fleet unit tours as department heads, executive officers and commanding

officers and sending them on to JDA and JPME billets. The JPME after postgraduate education is another worthwhile proposal that solves the JPME and JDA shortage problem while assuring quality personnel fill the billets without depleting the fleet unit billet fills. While the fixed proportion proposal will not drastically alter the SWO career path, the JPME after postgraduate education will slightly modify it, since it is not considered in the current SWO Professional Career Development Path.

C. RECOMMENDATIONS

FORECASTER could be used by community managers as an analytical tool to quantitatively analyze the impact a policy change or restructured career path will have on the personnel flow within the community. The model output of estimated distribution of personnel in the system and billets filled allow the managers to quickly gain an appreciation for the problems and potential solutions on a quantitative level.

The analysis in this study could be expanded to "soft" billet data. Specifically, it would be interesting to analyze what proportion of the "soft" billets should be manned by SWO's. In order to properly investigate this issue, it would be necessary for the other community managers. e.g., Aviation, Submarine, etc., to have similar community models available to analyze their communities and then compare various options of sharing the task of manning the soft billets. One of the

major advantages of this forecasting model is its user-interactive feature that allows community specific models to be established quite easily. Of course, the necessary data must also be gathered for each community to be analyzed.

The fixed percentage scenario opens up many avenues worthy of further investigation. The need to fill the joint billets with promotable officers is a problem for all the Defense Department communities that needs to be approached logically and sensibly. Convening an annual or semi-annual board to select from officers rotating off fleet units who have shown high quality performance could be one way of assuring that a fixed percentage of the SWO population is targeted for joint duty on a regular basis. Too often in the past the "crisis management" approach was taken leading to placing non-promotable officers in joint billets because all top performers were already in critical billets.

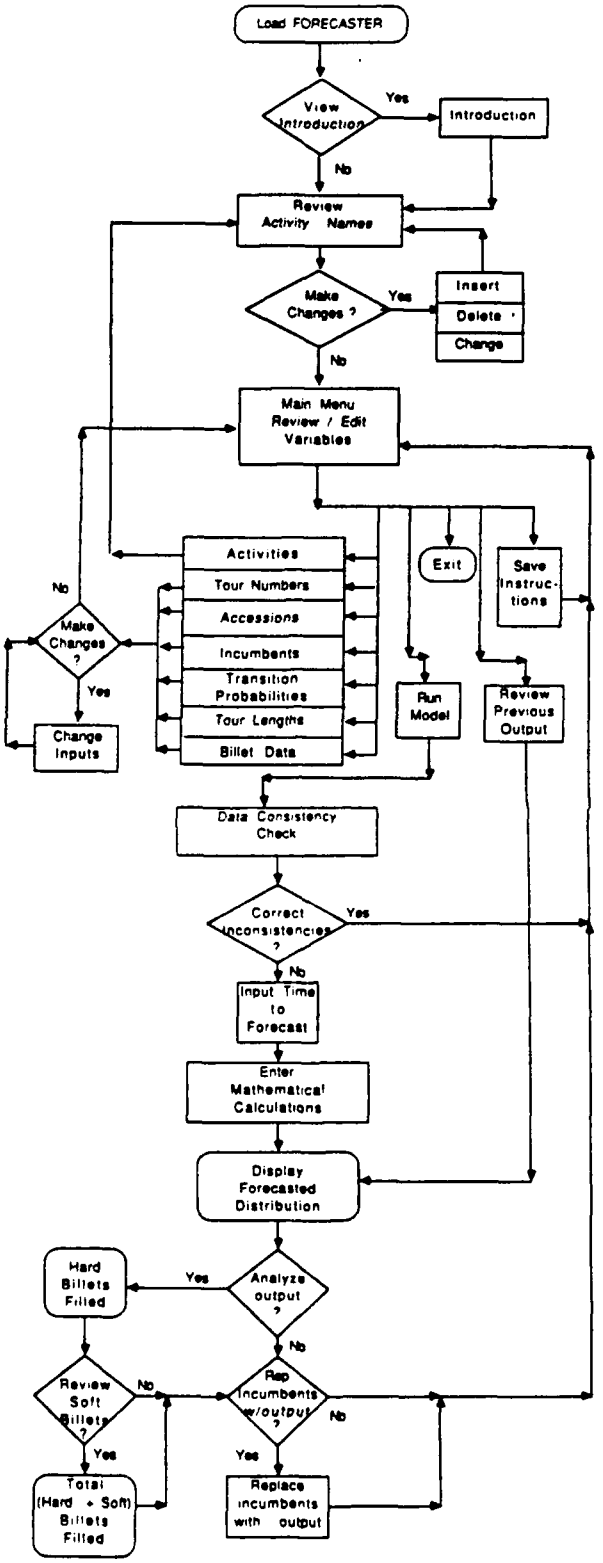
It would be also beneficial to pursue a cost effectiveness study of establishing a JPME curriculum at the Naval Postgraduate School, Monterey, California. The idea is effective, as the model results suggest, in enabling the Navy to meet JDA and JPME requirements. It would obviously save money in terms of PCS funds and should be further analyzed for its economic values.

Finally, in order to make FORECASTER easier to work with, NMPC should maintain the data in a more accessible format for FORECASTER to be utilized. Individual communities should

maintain tapes on their personnel to insure the accuracy of the data therein insuring accuracy of the model results. The benefits gained from an analytical tool such as FORECASTER are only as great as the accuracy of the model with which you are using.

APPENDIX A

FORECASTER FLOW CHART



APPENDIX B

VARIABLE/INPUT DATA

FOR ALL DATA EXCEPT TRANSITION PROBABILITIES, THE COLUMNS REPRESENT TOUR NUMBERS

ACCESSIONS ARE AS FOLLOWS:

1. POSTGRAD EDUC	0
2. JPME	0
3. JOINT TOUR	0
4. SWO EDUC	0
5. FLEET UNIT	315
6. SHORE DUTY	0

INCUMBENTS ARE AS FOLLOWS:

1. POSTGRAD EDUC	0	124	133	12	12	28	8	7	2	0	2	0
2. JPME	0	0	3	0	2	11	9	12	15	7	4	1
3. JOINT TOUR	0	1	3	3	3	12	15	36	91	41	39	19
4. SWO EDUC	0	24	55	69	15	9	0	0	0	0	0	0
5. FLEET UNIT	3744	765	168	299	465	253	225	194	313	172	69	46
6. SHORE DUTY	0	466	530	126	88	119	117	244	428	252	137	83

TOUR LENGTHS ARE AS FOLLOWS:

1. POSTGRAD EDUC	0	8	8	8	6	6	6	6	6	0	6	0
2. JPME	0	0	2	0	2	2	2	2	2	2	2	2
3. JOINT TOUR	0	8	8	8	8	8	8	8	8	8	8	8
4. SWO EDUC	0	2	2	2	2	2	0	0	0	0	0	0
5. FLEET UNIT	12	6	6	6	6	6	6	6	6	9	9	9
6. SHORE DUTY	0	8	8	8	8	8	8	8	8	8	8	8

HARD BILLETS ARE AS FOLLOWS:

1. POSTGRAD EDUC	0	120	130	0	10	20	5	0	0	0	0	0
2. JPME	0	0	0	0	0	20	15	25	40	10	10	0
3. JOINT TOUR	0	0	0	0	0	13	15	49	79	30	10	10
4. SWO EDUC	0	30	60	75	15	0	0	0	0	0	0	0
5. FLEET UNIT	3720	720	110	260	430	210	160	160	150	160	50	40
6. SHORE DUTY	0	300	342	70	52	167	90	130	143	220	98	40

SOFT BILLETS ARE AS FOLLOWS:

1. POSTGRAD EDUC	0	0	0	0	0	0	0	0	0	0	0	0
2. JPME	0	0	0	0	0	0	0	0	0	0	0	0
3. JOINT TOUR	0	0	0	0	0	60	63	0	100	110	85	60
4. SWO EDUC	0	0	0	0	0	0	0	0	0	0	0	0
5. FLEET UNIT	0	24	23	0	23	10	20	0	0	12	20	16
6. SHORE DUTY	0	410	210	0	0	310	290	0	297	186	170	120

IN TRANSITION PROBABILITY DATA, THE ROWS REPRESENT PRESENT ACTIVITY WHILE THE COLUMNS REPRESENT FUTURE ACTIVITIES. ROW NUMBERS (UP-DOWN) AND COLUMNS (LEFT-RIGHT) REPRESENT ACTIVITIES AS ORDERED IN MODEL

TRANSITION PROBABILITY MATRICES ARE AS FOLLOWS FOR STATUS QUO SCENARIO:

PROBABILITY VALUES						*TOUR TRANSITIONS*
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0.05	0	0	0.05	0.4	0.18	1 *TO* 2
0	0	0	0	0	0	
0	0	0	1	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	1	0	
0.13	0	0	0	0.1	0.52	2 *TO* 3
0	0	0	0.24	0	0	
0	0	0	1	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	1	0	
0	0	0	0	1	0	3 *TO* 4
0	0	0	0.33	0	0.25	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	1	0	
0.05	0	0	0	0.8	0.15	4 *TO* 5
0	0	0	0.5	0	0	
0	0	0	0	1	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	1	0	
0.05	0.07	0.02	0	0.36	0.4	5 *TO* 6
0	0	0	0	0.8	0	
0	0	0	0	1	0	
0	0	0.4	0	0.6	0	
0	0	0	0	0.85	0	
0	0	0	0	0	0	
0.05	0.1	0.04	0	0.4	0.4	6 *TO* 7
0	0	0	0	0.85	0	
0	0	0	0	1	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	
0	0	0	0	0	0	
0.05	0.15	0.05	0	0.25	0.5	7 *TO* 8
0	0	0	0	1	0	
0	0	0	0	1	0	
0	0	0.9	0	0.1	0	
0	0	0	0	1	0	
0	0	0	0	0	0	
0	0.15	0.15	0	0.25	0.45	8 *TO* 9
0	0	0	0	0.65	0.35	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	
0	0	0	0	0	0	
0	0.06	0.02	0	0.15	0.65	9 *TO* 10
0	0	0	0	0.45	0.25	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	0.95	0	10 *TO* 11

0	0	0	0	0	0	
0	0	0.1	0	0.15	0.4	
0	0	0	0	0.2	0.3	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0.8	0	11 *TO* 12
0	0	0	0	0	0	
0	0	0.2	0	0	0.35	
0	0	0	0	0.3	0.35	

TRANSITION PROBABILITY MATRICES ARE AS FOLLOWS FOR FIXED PROPORTION PROPOSAL SCENARIO:

PROBABILITY VALUES						*TOUR TRANSITIONS*
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	1 *TO* 2
0	0	0	0	0	0	
0.05	0	0	0.05	0.4	0.18	
0	0	0	0	0	0	
0	0	0	1	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	2 *TO* 3
0	0	0	0	1	0	
0.13	0	0	0	0.1	0.52	
0	0	0	0.24	0	0	
0	0	0	1	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	3 *TO* 4
0	0	0	0	1	0	
0	0	0	0	1	0	
0	0	0	0.33	0	0.25	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	4 *TO* 5
0	0	0	0	1	0	
0.05	0	0	0	0.8	0.15	
0	0	0	0.5	0	0	
0	0	0	0	1	0	
0	0	0	0	0	0	
0	0	0	0	0	0	5 *TO* 6
0	0	0	0	1	0	
0.05	0.1	0.06	0	0.31	0.38	
0	0	0	0	0.8	0	
0	0	0	0	1	0	
0	0	0.4	0	0.6	0	
0	0	0	0	0.85	0	6 *TO* 7
0	0	0	0	0	0	
0.05	0.15	0.1	0	0.3	0.34	
0	0	0	0	0.85	0	
0	0	0	0	1	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	7 *TO* 8
0	0	0	0	0	0	
0.05	0.2	0.1	0	0.2	0.44	
0	0	0	0	1	0	
0	0	0	0	1	0	
0	0	0.9	0	0.1	0	
0	0	0	0	1	0	8 *TO* 9
0	0	0	0	0	0	

0	0.15	0.15	0	0.25	0.45	
0	0	0	0	0.65	0.35	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	9 *TO* 10
0	0	0	0	0	0	
0	0.15	0.12	0	0.13	0.55	
0	0	0	0	0.45	0.25	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	0.95	0	10 *TO* 11
0	0	0	0	0	0	
0	0.15	0.15	0	0.1	0.25	
0	0	0	0	0.2	0.3	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	0.9	0	11 *TO* 12
0	0	0	0	0	0	
0	0.1	0.2	0	0	0.3	
0	0	0	0	0.3	0.35	

TRANSITION PROBABILITY MATRICES ARE AS FOLLOWS FOR JPME FOLLOWING PG EDUCATION PROPOSAL SCENARIO

PROBABILITY VALUES *TOUR TRANSITIONS*

0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	1 *TO* 2
0.05	0	0	0.05	0.4	0.18	
0	0	0	0	0	0	
0	0.4	0	0.6	0	0	
0	0	0	0	0	0	
0	0	0	0	0	0	2 *TO* 3
0	0	0	0	1	0	
0.13	0	0	0	0.1	0.52	
0	0	0	0.24	0	0	
0	0.4	0	0.6	0	0	
0	0	0.5	0.5	0	0	
0	0	0	0	0	0	3 *TO* 4
0	0	0	0	1	0	
0	0	0	0	1	0	
0	0	0	0.33	0	0.25	
0	0	0	0	0	0	
0	0	0.5	0.5	0	0	
0	0	0	1	0	0	4 *TO* 5
0	0	0	0	1	0	
0.05	0	0	0	0.8	0.15	
0	0	0	0.5	0	0	
0	0.5	0	0	0.5	0	
0	0	0	0	0	0	
0	0	0	1	0	0	5 *TO* 6
0	0	0	0	1	0	
0.05	0.07	0.02	0	0.36	0.4	
0	0	0	0	0.8	0	
0	0.5	0	0	0.5	0	
0	0	0.4	0	0.6	0	
0	0	0	0	0.85	0	6 *TO* 7
0	0	0	0	1	0	
0.05	0.1	0.04	0	0.4	0.4	

0	0	0	0	0.85	0	
0	0.5	0	0	0.5	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	7 *TO* 8
0	0	0	0	0	0	
0.05	0.15	0.05	0	0.25	0.5	
0	0	0	0	1	0	
0	0.5	0	0	0.5	0	
0	0	0.9	0	0.1	0	
0	0	0	0	1	0	8 *TO* 9
0	0	0	0	0	0	
0	0.15	0.15	0	0.25	0.45	
0	0	0	0	0.65	0.35	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	1	0	9 *TO* 10
0	0	0	0	0	0	
0	0.06	0.02	0	0.15	0.65	
0	0	0	0	0.45	0.25	
0	0	0	0	0	0	
0	0	0.5	0	0.5	0	
0	0	0	0	0.95	0	10 *TO* 11
0	0	0	0	0	0	
0	0	0.1	0	0.15	0.4	
0	0	0	0	0.2	0.3	
0	0	0	0	0	0	
0	0	0	0	0	0	
0	0	0	0	0.8	0	11 *TO* 12
0	0	0	0	0	0	
0	0	0.2	0	0	0.35	
0	0	0	0	0.3	0.35	

APPENDIX C

SAMPLE USER SESSION WITH FORECASTER

```
SAMPLE SESSION OF FORECASTER RUN ON IBM 3033 MAINFRAME COMPUTER AT
NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIFORNIA.


APL
N (193) R/O
M (194) R/O

      V S  A P L   4.0

CLEAR WS
      )LOAD FORECAST
SAVED 16:15:55 03/03/89
WSSIZE IS 640092
DO YOU WISH TO REVIEW THE INTRODUCTION? ('Y' OR HIT ENTER TO SKIP)
Y
WELCOME TO FORECASTER

THE PURPOSE OF THIS USER INTERACTIVE MATHEMATICAL MODEL IS TO
PROVIDE THE USER  A TOOL WITH WHICH TO QUANTITATIVELY LOOK AT
PERSONNEL FLOW IN THE USER ESTABLISHED SYSTEM.

BY ESTABLISHING THE ACTIVITIES (BILLET CLASSIFICATION GROUPS) AND
THE TOUR NUMBERS, THE USER WILL DEFINE THE SYSTEM OR COMMUNITY
WHERE PERSONNEL FLOW WILL BE MODELED.

THE VARIABLES IN FORECASTER WHILE SELF-EXPLANATORY, WILL BE
DESCRIBED ON THE FOLLOWING SCREEN

HIT ENTER TO CONTINUE

THE VARIABLES USDE BY FORECASTER ARE:

1. ACCESSIONS--NUMBER OF PERSONNEL ENTERING THE SYSTEM PER TIME
              INTERVAL
2. LENGTH OF TOURS--DURATION OF ACTIVITY FOR A TOUR NUMBER
3. INCUMBENTS--PERSONNEL IN ACTIVITIES AND TOUR NUMBERS PRIOR TO
              FORECASTING
4. TRANSITION PROBABILITY--PROBABILITY OF TRANSITTING FROM ONE
                           ACTIVITY TO ANOTHER WHEN PROCEDING FROM
                           TOUR TO THE NEXT
5. TIME TO FORECAST--TIME UNITS DESIRED TO FORECAST INTO THE
                     FUTURE
6. BILLET DATA--'HARD' AND 'SOFT' BILLETS FOR AN ACTIVITY AND
                TOUR NUMBER
7. TOUR NUMBERS--NUMBER OF TOURS ESTABLISHED FOR THE MODELED
                 SYSTEM
8. ACTIVTY--MUTUALLY EXCLUSIVE BILLET CLASSIFICATIONS

ALL THESE INPUTS CAN BE CHANGED THROUGH THE MENU AND VARIOUS
PROMPTS GIVEN THROUGHOUT THE PROGRAM.

HIT ENTER TO REVIEW THE CURRENT ACTIVITIES AND BEGIN RUNNING
FORECASTER.

THE FOLLOWING IS A LIST OF ACTIVITY NAMES AS THEY WILL APPEAR
IN THE OUTPUT:

 1. POSTGRAD EDUC
 2. JPME
 3. JOINT TOUR
 4. SWO EDUC
 5. FLEET UNIT
 6. SHORE DUTY
```

```
IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU

                          FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
                         (N)AME OF ACTIVITIES
                         (T)OUR NUMBERS
                         (L)ENGTH OF TOURS
                         (A)CCESSIONS
                         (I)NCUMBENTS
                         (P)ROBABILITY OF TRANSITION
                         (B)ILLET DATA (HARD/SOFT)
                         (G)O AND RUN MODEL WITH CURRENT INPUTS
                         (R)EVIEW PREVIOUS OUTPUT / ANALYSIS
                         (S)AVE INPUT VALUES
                         (E)XIT THE PROGRAM
A
CURRENT ACCESSIONS ARE AS FOLLOWS:

 1. POSTGRAD EDUC    0
 2. JPME             0
 3. JOINT TOUR       0
 4. SWO EDUC         0
 5. FLEET UNIT     315
 6. SHORE DUTY       0

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C
INPUT THE  NEW ACCESSION VALUES (6 NUMBERS) SEPERATED BY A SPACE
?:
      0 0 0 0 330 0
CURRENT ACCESSIONS ARE AS FOLLOWS:

 1. POSTGRAD EDUC    0
 2. JPME             0
 3. JOINT TOUR       0
 4. SWO EDUC         0
 5. FLEET UNIT     330
 6. SHORE DUTY       0

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU

                          FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
                         (N)AME OF ACTIVITIES
                         (T)OUR NUMBERS
                         (L)ENGTH OF TOURS
                         (A)CCESSIONS
                         (I)NCUMBENTS
                         (P)ROBABILITY OF TRANSITION
                         (B)ILLET DATA (HARD/SOFT)
                         (G)O AND RUN MODEL WITH CURRENT INPUTS
                         (R)EVIEW PREVIOUS OUTPUT / ANALYSIS
                         (S)AVE INPUT VALUES
                         (E)XIT THE PROGRAM
I
CURRENT INCUMBENTS ARE AS FOLLOWS:
```

```
 1. POSTGRAD EDUC      0  124  133   12   12   28    8    7    2    0    2    0
 2. JPME               0    0    3    0    2   11    9   12   15    7    4    1
 3. JOINT TOUR         0    1    3    3    3   12   15   36   91   41   39   19
 4. SWO EDUC           0   24   55   69   15    9    0    0    0    0    0    0
 5. FLEET UNIT      3744  765  168  299  465  253  225  194  313  172   69   46
 6. SHORE DUTY         0  466  530  126   88  119  117  244  428  252  137   83

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C

INPUT THE TOUR NUMBER FOR THE INCUMBENTS VALUES YOU WANT TO CHANGE
AND HIT ENTER (ONLY ONE NUMBER)
?:
      5

 1. POSTGRAD EDUC  12
 2. JPME            2
 3. JOINT TOUR      3
 4. SWO EDUC       15
 5. FLEET UNIT    465
 6. SHORE DUTY     88

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C
INPUT THE NEW INCUMBENTS VALUES FOR TOUR NUMBER 5
( 6 VALUES SEPERATED BY A SPACE)
?:
      12 0 0 15 465 100
CURRENT INCUMBENTS ARE AS FOLLOWS:

 1. POSTGRAD EDUC      0  124  133   12   12   28    8    7    2    0    2    0
 2. JPME               0    0    3    0    0   11    9   12   15    7    4    1
 3. JOINT TOUR         0    1    3    3    0   12   15   36   91   41   39   19
 4. SWO EDUC           0   24   55   69   15    9    0    0    0    0    0    0
 5. FLEET UNIT      3744  765  168  299  465  253  225  194  313  172   69   46
 6. SHORE DUTY         0  466  530  126  100  119  117  244  428  252  137   83

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU

                        FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
                        (N)AME OF ACTIVITIES
                        (T)OUR NUMBERS
                        (L)ENGTH OF TOURS
                        (A)CCESSIONS
                        (I)NCUMBENTS
                        (P)ROBABILITY OF TRANSITION
                        (B)ILLET DATA (HARD/SOFT)
                        (G)O AND RUN MODEL WITH CURRENT INPUTS
                        (R)EVIEW PREVIOUS OUTPUT / ANALYSIS
                        (S)AVE INPUT VALUES
                        (E)XIT THE PROGRAM
L
CURRENT TOUR LENGTH ARE AS FOLLOWS:

 1. POSTGRAD EDUC  0  8  8  8  6  6  6  6  6  0  6  0
 2. JPME           0  0  2  0  2  2  2  2  2  2  2  2
 3. JOINT TOUR     0  8  8  8  8  8  8  8  8  8  8  8
 4. SWO EDUC       0  2  2  2  2  2  0  0  0  0  0  0
```

```
 5. FLEET UNIT     12  6  6  6  6  6  6  6  6  9  9  9
 6. SHORE DUTY      0  8  8  8  8  8  8  8  8  8  8  8

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C

INPUT THE TOUR NUMBER FOR THE TOUR LENGTH VALUES YOU WANT TO CHANGE
AND HIT ENTER (ONLY ONE NUMBER)
□:
     10

 1. POSTGRAD EDUC 0
 2. JPME          2
 3. JOINT TOUR    8
 4. SWO EDUC      0
 5. FLEET UNIT    9
 6. SHORE DUTY    8

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C
INPUT THE NEW TOUR LENGTH VALUES FOR TOUR NUMBER 10
( 6 VALUES SEPERATED BY A SPACE)
□:
     0 2 10 0 9 8
CURRENT TOUR LENGTH ARE AS FOLLOWS:

 1. POSTGRAD EDUC  0  8  8  8  6  6  6  6  6  0  6  0
 2. JPME           0  0  2  0  2  2  2  2  2  2  2  2
 3. JOINT TOUR     0  8  8  8  8  8  8  8  8 10  8  8
 4. SWO EDUC       0  2  2  2  2  2  0  0  0  0  0  0
 5. FLEET UNIT    12  6  6  6  6  6  6  6  6  9  9  9
 6. SHORE DUTY     0  8  8  8  8  8  8  8  8  8  8  8

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU

                          FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
                        (N)AME OF ACTIVITIES
                        (T)OUR NUMBERS
                        (L)ENGTH OF TOURS
                        (A)CCESSIONS
                        (I)NCUMBENTS
                        (P)ROBABILITY OF TRANSITION
                        (B)ILLET DATA (HARD/SOFT)
                        (G)O AND RUN MODEL WITH CURRENT INPUTS
                        (R)EVIEW PREVIOUS OUTPUT / ANALYSIS
                        (S)AVE INPUT VALUES
                        (E)XIT THE PROGRAM
P
THERE ARE CURRENTLY 11 PROBABILITY OF TRANSITION MATRICES
THAT ARE USED AS INPUTS.  THEY REPRESENT THE CHANCE OF MOVING FROM
ONE ACTIVITY TO ANOTHER WHEN PROCEEDING TO THE NEXT TOUR NUMBER.
YOU WILL BE PROMPTED AS TO WHICH MATRIX YOU WOULD LIKE TO LOOK OVER
AND YOU WILL BE GIVEN THE OPTION OF CHANGING THE INPUTS.


KEEP IN MIND THAT FOR A SINGLE ACTIVITY (ROW) IN THE MATRIX, THE SUM
OF THE NUMBERS FOR THAT ACTIVITY SHOULD BE LESS THAN OR EQUAL TO
ONE (1).
```

```
THE INPUTS MUST BE ENTERED AS A DECIMAL UNLESS THE INPUT IS '1',
SUGGESTING THAT THE CHANCE OF GOING FROM ONE ACTIVITY TO ANOTHER
IS 100 PERCENT ASSURED. CHANCE OF SEPERATION FROM THE COMMUNITY IS
1 MINUS THE SUM OF THE PROBABILITIES OF TRANSITING FROM ONE SPECIFIC
ACTIVITY TO ALL OTHERS IN THAT TOUR.

HIT ENTER TO CONTINUE

ENTER THE NUMBER OF THE TRANSITION PROBABILITY MATRIX YOU WOULD
LIKE TO VIEW WITH THE OPTION OF ALTERING.

THE NUMBER MUST BE AN INTEGER BETWEEN 1 AND 11 FOR THE CURRENT SETUP

ENTER THE NUMBER AND HIT ENTER
C:
      1
CURRENT PROBABILITY OF TRANSITING FROM ONE ACTIVITY TO ANOTHER
GOING FROM TOUR NUMBER 1 TO TOUR NUMBER 2:


 1. POSTGRAD EDUC 0     0     0     0     0     0
 2. JPME          0     0     0     0     0     0
 3. JOINT TOUR    0     0     0     0     0     0
 4. SWO  EDUC     0     0     0     0     0     0
 5. FLEET UNIT    0.05  0     0     0.05  0.4   0.18
 6. SHORE DUTY    0     0     0     0     0     0


IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                      OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU
C
INPUT THE PRESENT ACTIVITY NUMBER (ROW) VALUE YOU WANT TO CHANGE:
AND HIT ENTER (ONE NUMBER ONLY)
C:
      5
THE PROBABILITY OF TRANSITING FROM FLEET UNIT
TO ALL OTHER ACTIVITIES IS:


FLEET UNIT     0.05 0     0     0.05 0.4   0.18


TO CHANGE THESE VALUES TYPE 'C' AND HIT ENTER; OR JUST HIT ENTER
TO RETURN TO MATRIX MENU
C
INPUT THE NEW PROBABILITY VALUES FOR TRANSITING FROM FLEET UNIT
FROM TOUR NUMBER 1 TO TOUR NUMBER 2. (6 NUMBERS
EACH SEPERATED BY A SPACE) AND HIT ENTER

WARNING: THE NUMBERS MUST BE BETWEEN 0 AND 1 INCLUSIVE [EX: .25, .5, 01, ETC.]

EACH NUMBER REPRESENTS THE PROBABILITY OF TRANSITING TO THE NUMBERED
ACTIVITY CORRESPONDING TO ITS RANK IN THE SEQUENCE OF NUMBERS
BE SURE THE SUM OF YOUR INPUTS IS NOT GREATER THAN ONE
C:
      .2 0 0 .1 .5 .3
YOUR PROBABILITY OF EXITING THIS ACTIVITY IS GREATER THAN ONE (1)
WHICH IS NOT ALLOWED. REVIEW YOUR INPUTS AND HIT ENTER TO CONTINUE

EACH NUMBER REPRESENTS THE PROBABILITY OF TRANSITING TO THE NUMBERED
ACTIVITY CORRESPONDING TO ITS RANK IN THE SEQUENCE OF NUMBERS
BE SURE THE SUM OF YOUR INPUTS IS NOT GREATER THAN ONE
C:
      .1 0 0 .1 .3 .2
CURRENT PROBABILITY OF TRANSITING FROM ONE ACTIVITY TO ANOTHER
GOING FROM TOUR NUMBER 1 TO TOUR NUMBER 2:
```

```
 1. POSTGRAD EDUC 0    0    0    0    0    0
 2. JPME          0    0    0    0    0    0
 3. JOINT TOUR    0    0    0    0    0    0
 4. SWO EDUC      0    0    0    0    0    0
 5. FLEET UNIT    0.1  0    0    0.1  0.3  0.2
 6. SHORE DUTY    0    0    0    0    0    0

IF YOU WOULD LIKE TO CHANGE THE VALUES TYPE 'C' AND HIT ENTER
                    OR
IF YOU ACCEPT THE CURRENT VALUES JUST HIT ENTER TO RETURN TO MENU

WOULD YOU CARE TO VIEW OR ALTER ANOTHER PROBABILITY OF TRANSITION
MATRIX ( C ) OR RETURN TO MAIN MENU (HIT ENTER ONLY).

                          FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
                        (N)AME OF ACTIVITIES
                        (T)OUR NUMBERS
                        (L)ENGTH OF TOURS
                        (A)CCESSIONS
                        (I)NCUMBENTS
                        (P)ROBABILITY OF TRANSITION
                        (B)ILLET DATA (HARD/SOFT)
                        (G)O AND RUN MODEL WITH CURRENT INPUTS
                        (R)EVIEW PREVIOUS OUTPUT / ANALYSIS
                        (S)AVE INPUT VALUES
                        (E)XIT THE PROGRAM
G
IF YOU WANT TO BE WARNED ABOUT DATA INCONSISTENCIES, TYPE 'W' AND
HIT ENTER; OR JUST HIT ENTER TO CONTINUE AND SKIP THE DATA CHECK

INPUT THE NUMBER OF QUARTERS (INTEGER ONLY) YOU WISH TO FORECAST
?
      7

EXPECTED DISTRIBUTION OF OFFICERS 7 QUARTERS FROM PRESENT:

ACTIVITIES

POSTGRAD EDUC      0  234  129    2   15   23   13   11    0    0    0    0
JPME               0    0    0    0    0   11    9   12    9    5    0    0
JOINT TOUR         0    0    0    0    0   13   30   34   81   39   30   13
SWO EDUC           0   62   60   78   16    0    0    0    0    0    0    0
FLEET UNIT      3870  562  241  342  474  290  239  180  209  357  119   74
SHORE DUTY         0  495  514  132   66  232  135  165  230  352  137   71

HIT ENTER TO CONTINUE

TYPE 'A' AND HIT ENTER TO ANALYZE THE RESULTS; OR JUST HIT ENTER
TO CONTINUE
?
THE FOLLOWING IS A SUMMARY OF THE NUMBER OF OFFICERS PER ACTIVITY

POSTGRAD EDUC   427
JPME             46
JOINT TOUR      240
SWO EDUC        216
FLEET UNIT     6957
SHORE DUTY     2529

THE FOLLOWING IS THE TOTAL NUMBER OF OFFICERS IN THE SYSTEM:
10415
```

PRESS ANY KEY AND HIT ENTER TO SEE THE FORECASTED DISTRIBUTION VERSUS HARD BILLET DATA

THE FOLLOWING IS A SUMMARY OF THE NUMBER OF OFFICERS PER ACTIVITY COMPARED WITH THE HARD BILLETS AVAILABLE:

1.	0	114	-1	2	5	-3	-8	-11	-0	-0	-0	0
2.	0	0	0	0	0	-9	-6	-13	-31	-5	-10	0
3.	0	0	0	0	0	0	15	-15	2	9	20	3
4.	0	-32	0	3	1	0	0	0	0	0	0	0
5.	150	-158	131	82	44	80	79	20	59	197	69	34
6.	0	195	172	62	14	65	45	35	87	132	39	31

1. POSTGRAD EDUC
2. JPME
3. JOINT TOUR
4. SWO EDUC
5. FLEET UNIT
6. SHORE DUTY

THE NEGATIVE VALUES REFLECT SHORTAGES
POSITIVE VALUES REFLECT EXCESS FILL

HIT ENTER TO CONTINUE

THE PERCENTAGE OF HARD BILLETS FILLED VERSUS FORECASTED DISTRIBUTION IS AS FOLLOWS:

1.	0	195	99	200	150	115	260	1100	0	0	0	0
2.	0	0	0	0	0	55	60	48	22	50	0	0
3.	0	0	0	0	0	100	200	69	103	130	300	130
4.	0	207	100	104	107	0	0	0	0	0	0	0
5.	104	78	219	132	110	138	149	113	139	223	238	185
6.	0	165	150	189	127	139	150	127	161	160	140	177

1. POSTGRAD EDUC
2. JPME
3. JOINT TOUR
4. SWO EDUC
5. FLEET UNIT
6. SHORE DUTY

VALUES BELOW 100 (PERCENT) REFLECT HARD BILLET SHORTAGES
VALUES ABOVE 100 (PERCENT) REFLECT HARD BILLET EXCESS

HIT ENTER TO CONTINUE

TYPE 'T' AND HIT ENTER TO SEE THE COMPARISON OF THE FORECASTED DISTRIBUTION AND THE TOTAL BILLETS (HARD PLUS SOFT)
OR
JUST HIT ENTER TO CONTINUE

TYPE 'R' AND HIT ENTER TO REPLACE THE INCUMBENTS WITH THE FORECASTED DISTRIBUTION; OR JUST HIT ENTER TO CONTINUE

FORECASTER MENU

PLEASE TYPE THE LETTER IN PARENTHESES TO REVIEW OR CHANGE THE SETTINGS
(N)AME OF ACTIVITIES
(T)OUR NUMBERS
(L)ENGTH OF TOURS
(A)CCESSIONS
(I)NCUMBENTS
(P)ROBABILITY OF TRANSITION
(B)ILLET DATA (HARD/SOFT)
(G)O AND RUN MODEL WITH CURRENT INPUTS
(R)EVIEW PREVIOUS OUTPUT / ANALYSIS
(S)AVE INPUT VALUES
(E)XIT THE PROGRAM

E
ONCE YOU EXIT, ALL YOUR INPUT CHANGES WILL BE LOST UNLESS YOU SAVE

```
THE CURRENT SET-UP.  IF YOU WANT DIRECTIONS ON HOW TO SAVE THE SET-UP
TYPE 'S' AND HIT ENTER, OR JUST HIT ENTER TO EXIT

YOU HAVE EXITED FORECASTER! HOPE YOU ENJOYED IT!!
TO RETURN, TYPE 'FORECASTER' AND HIT ENTER AND YOU WILL BE BACK IN
THE PROGRAM.
      )OFF
```

APPENDIX D

FORECASTER USER MANUAL

A. INTRODUCTION

FORECASTER is a user-interactive personnel flow model which forecasts the estimated distribution of personnel in a user defined community for some time interval into the future. The program is written in A Programming Language (APL) and is completely menu driven. It is the user's responsibility to properly establish the community in terms of activities (defined as mutually exclusive billet classifications) and tour numbers. The set up may be altered in any way the user desires as will be explained later in this manual. The purpose here is to acquaint the user with how to run FORECASTER. In sequential fashion, this manual will cover information from entering, running, and exiting FORECASTER.

B. GETTING STARTED

As mentioned in the introduction, FORECASTER is written in APL and can only be run on systems where APL is available. The only prior knowledge of APL that is required is an understanding of how to enter the workspace where FORECASTER is maintained. By loading the workspace "Forecast," FORECASTER is entered automatically. To load a workspace in APL, the user must first have the keyboard set for the APL

environment. The command to load a workspace is right parenthesis (")") then type LOAD <space> FORECAST (i.e.,)LOAD FORECAST).

Upon entering FORECASTER, the option of looking at a brief, two screen introduction is offered. First time users should read that introduction, others can proceed to the next screen by hitting "Enter" or "Return". After the introduction, if read, is a review of the current activities. New activities may be inserted while current ones may be deleted or changed. The maximum number of characters an activity may contain is thirteen, while the maximum number of activities allowed by FORECASTER is nine.

To insert a new activity, type "I" and hit Enter from the activity option menu. Prompts as to how to insert the new activity name are then shown. Once a new activity is inserted, the other inputs (which will be discussed later) will be set at zero for this new activity. It is up to the user to input the new values for all the other variables utilized by FORECASTER.

By typing a "D" from the activity option menu, deleting current activities is also possible. Again, prompts provide the explicit directions on how to proceed in deleting an activity. Once the activity is deleted, the variable values associated with that activity are also cleared from FORECASTER. The names of activities can also be changed by typing "C" in the activity option menu. Changing the name has

no effect on any of the variable values that are associated with the activity. After reviewing and possibly changing the activities set up, the user will be transferred to the main menu.

C. MAIN MENU

The main menu is where the user can alter any variable values in FORECASTER, execute the forecasting for a specified time interval, and analyze the output. The main menu will appear on the screen as shown below:

> Please type in the letter in parenthesis to review or change the settings:
>
> (N)ame of Activities
> (T)our Numbers
> (L)ength of Tours
> (A)ccessions
> (I)ncumbents
> (P)robability of Transition
> (B)illet Data (Hard/Soft)
> (G)o and Run Model with Current Inputs
> (R)eview Previous Output/Analysis
> (S)ave Input Values
> (E)xit the Program

Typing the letter in parenthesis allows the user to review and possibly change the variable listed or execute the action it implies (i.e., go and run the model, review output, etc.). Each option will now be described and discussed individually.

1. Name of Activities

The same options described earlier for activity change, deletion and insertion are possible from the main menu via this option.

2. Tour Numbers

The tour numbers used to establish the community may be altered with this option. Tour numbers may be added or deleted. If they are added, they are added on after the last current tour number. Zeros are automatically inserted for the new tour numbers and current activities for all the variables in FORECASTER. The maximum number of tours FORECASTER can accept is twelve. If deleted, tour numbers are deleted from the largest tour down. For example, if you have ten tour numbers and desire to delete four, then the resultant number of tours would be six with all the variables only having their first through sixth tour data. The inputs for the final four tours will be lost. The minimum number of tours FORECASTER can accommodate is two.

3. Length of Tours

The length of the tours refers to the duration of a tour for specific activities and tour numbers. Based on the time scale used, the tour length is a positive integer value reflecting the number of month, quarters or years. These values may be changed by the user selecting the tour number of the tour length to be changed. The tour length values for this tour number are displayed for all activities and the user may choose to change or accept them. If it is desired to change these values, the user must enter tour length values for all activities for that tour number.

4. Accessions

Accessions refer to the number of personnel entering the community for each unit of time being forecast. For example, if forecasting is being done for fifteen quarters, there will be fifteen accessions throughout the forecasting period. The number of accession values equal the number of activities and the values must be non-negative integers.

5. Incumbents

Incumbents refer to the number of personnel in an activity and tour number prior to starting the forecast. Incumbent data is changed similarly to the procedure by which tour length data is altered. By choosing a tour number, the number of incumbents are displayed and, if necessary, they can be changed by inputting the number of incumbents for each activity for the tour number chosen. Values again must be non-negative integers.

6. Probability of Transition

The probability of transition refers to the chance a person has of leaving one activity and going to another when moving from one tour to the next successive tour. Alternately, these values may be thought of as the percentages of the total number of personnel that leave a specific activity and tour number each time interval and proceed on to the next tour number and destination activity. In the program, the user is briefed on the purpose of the transition probabilities, then will be asked to choose a transition matrix to review. The

user can then alter the transition matrix, review another matrix, or return to the main menu.

The transition probability matrix has the same number of rows and columns as activities. There are one fewer transition matrices as tour numbers. Transition probability matrix 1, for example, refers to the matrix consisting of probability values between 0 and 1 that represent going from an activity in tour one (the rows) to an activity in tour two (the columns). The sum of the probabilities for any one activity across all the columns must be less than or equal to 1, with one minus the sum representing the probability of separation from the community during that tour. The user may pick an activity (row) to change, is then prompted to input as many values as the number of activities in the community. Each value represents the percentage transiting from a present activity chosen to another activity, during the next tour.

7. Billet Data

Billet data refers to the number of "hard" (must fill billets only by personnel in the community) and "soft" (1000 or 1050 designated) billets that are allocated to the community. Similar to the incumbent data and tour length data, these values can be changed by tour numbers when prompted on the screen. Only non-negative integers are accepted and the number of values must equal the number of activities.

8. Go and Run the Model With Current Inputs

This will be covered in Section C--Model Runs.

9. Review Previous OUtput/Analysis

This option allows the user to review the results and analysis from the most recent model run. If desired, the forecasted distribution can be chosen to replace the current incumbent data.

10. Save Input Values

This option gives instructions on how to save the variable values currently established in FORECASTER. After exiting the program, the user must type ")SAVE" to keep the current inputs intact for the next time the model is used. If the user exits the workspace without saving, then the variables will all be changed back to their original values.

11. Exit the Program

This option allows the user to exit the program and re-emphasizes not to forget the save option if the user intends to retain the variables at their new values.

D. MODEL RUNS

1. Data Consistency Checks

When the user actually goes and runs the model, FORECASTER conducts various data consistency checks to insure the variable values are consistent with one another. When inconsistencies occur, warnings are issued to the user for each data inconsistency infraction. Specifically, accessions

are checked to insure first, that there are accession values, second, that there is a tour length where people are entering the community, and third, that there is a transition probability moving them out of that acitivity which they enter. Each incumbent value is checked to make sure there is a corresponding positive tour length to it. If there is no positive tour length, incumbents would not remain in that specific tour number and activity for any length of time. Incumbent data is also checked against the transition probabilities to insure there exists a probability for an incumbent to leave a tour number and activity. If there is no chance of leaving an activity, then all the incumbents will eventually attrite the community without advancing to another activity in the next tour number. Finally, a check is conducted for personnel being transited to an activity where there is no positive tour length.

The user has the option of calling off these warnings prior to conducting the data consistency check. If the user chooses to be warned of inconsistencies, each warning gives the user the option of returning to the main menu to correct it or continuing on and reviewing the data for other inconsistencies.

2. Input Time to Forecast

After the data consistency check, the user inputs the number of quarters desired to forecast. This number must be

a positive integer value. After entering the value, the forecasted distribution is computed.

3. Forecasted Distribution

The forecasted distribution is in the same format as the incumbent data, in terms of activities and tour numbers. It represents the estimated placement of personnel in the system given the variable inputs by the user.

4. Analysis of Output

The user has the option of further analyzing the forecasted distribution. If this is done, the user sees the forecast broken down into an aggregate sum for each activity and also for the entire community as a whole. The forecasted distribution is then compared to the "hard" billet data in terms of a straight comparison where positive numbers represent forecasted excess personnel over "hard" billets available and negative numbers reflect personnel shortages. This comparison is also given in terms of percentages. The user has the option of comparing the forecasted distribution to the total number of billets ("hard" plus "soft") in the same format as the "hard" billet comparison.

5. Replacing Incumbents with Output

As mentioned earlier, the user has the option of replacing the incumbent data with the forecasted distribution. After this option is executed, the user is returned to the main menu.

E. ERROR CHECKS

All the inputs FORECASTER requires are error checked. If negative numbers or non-integers are used when input calls for non-negative integers, an error message appears and the user is instructed to hit enter and try again. If the input requires a specific letter and the user fails to enter it properly, error messages follow with instructions to try again. Also, if the user does not input the proper number of values requested, FORECASTER issues an error message and allows the user to try again. As the user becomes more familiar with FORECASTER, the errors should diminish. Consistency is maintained with the menus and their required responses to better serve the user.

F. CONCLUSIONS

In conclusion, FORECASTER is a tool with which personnel flow is modeled. The community set up should be established to allow the user to effectively analyze personnel flow for specific activities. The variables in FORECASTER should be accurate as much as possible, especially the incumbent, accession, tour length and billet data. The transition probabilities may have to be approximated based on current personnel flow, though it is through manipulation of these probabilities that many hypothetical questions are ascertained.

The model is intended to answer "what if" questions and should be used to quantitatively analyze the impact of policies or restructuring of career paths. Giving the "big picture" in terms of forecasting potential manpower problems and assisting in making policy decisions impacting personnel flow is the true objective of FORECASTER.

LIST OF REFERENCES

1. Hughes, Wayne P., Jr., Military Modeling, The Military Operations Research Society, Inc., Alexandria, VA, 1984.

2. Walker, James W., Human Resource Planning, McGraw Hill, Inc., NY, 1980.

3. Title IV DoD Reorganization Act of 1986: A Guide to Joint Officer Management, Director for Manpower and Personnel, Joint Staff, Washington D.C., 1988.

4. Department of Defense (DoD) Reorganization Act of 1986 (Goldwater-Nichols Act), Public Law 99-433 (October 1, 1986).

5. U.S. Navy Unrestricted Line Officer Career Planning Guidebook (OPNAV P-13-1-86); U.S. Government Printing Office, 1986.

6. Howe, Robert H., "The Effect of PCS Policy Change on Surface Warfare Office Career Development," Master's Thesis, Naval Postgraduate School, Monterey, CA, 1984.

7. Amirault, Richard B., "SWOPATH: An Interactive Network Flow Model Simulating the U.S. Navy Surface Warfare Officer Career Paths," Master's Thesis, Naval Postgraduate School, Monterey, CA, 1985.

8. Mygas, Nicholas F., "Alternative Surface Warfare Officer Career Paths and Their Potential for Reducing Permanent Change of Station Costs," Master's Thesis, Naval Postgraduate School, Monterey, CA, 1985.

9. Steward, Thomas F., "The Effect of the Goldwater-Nichols Department of Defense Reorganization Act on Surface Warfare Officer Career Paths," Master's Thesis, Naval Postgraduate School, Monterey, CA, 1987.

10. Milch, Paul R., An Analytical Model for Forecasting Navy Officer Career Paths, Technical Report NPS55-88-009. Naval Postgraduate School, Monterey, CA, 1988.

11. Burack, Elmer H., and Walker, Jane W. Manpower Planning and Programming, Allen and Bacon, Inc., Boston, MA, 1972.

12. Grinold, Richard G., and Marshall, Kneale T., Manpower Planning Models, North-Holland, NY, 1977.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Technical Information System Cameron Station Alexandria, VA 22304-6145	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, CA 93943-5002	2
3.	Dr. Paul R. Milch, Code 55 Mh Department of Operations Research Naval Postgraduate School Monterey, CA 93943-5000	7
4.	CDR Thomas E. Halwachs, Code 55 Ha Department of Operations Research Naval Postgraduate School Monterey, CA 93943-5000	1
5.	CDR Brad Kaplan (OP-130E1) Office of the Chief of Naval Operations Department of the Navy Washington, DC 20350-2000	1
6.	CDR Wesley H. Schmidt (OP-130E40) Office of the Chief of Naval Operations Department of the Navy Washington, DC 20350-2000	1
7.	LCDR Michael Driggers (OP-130E40C) Office of the Chief of Naval Operations Department of the Navy Washington, DC 20350-2000	1
8.	Center For Naval Analysis 4401 Ford Avenue Post Office Box 16268 Alexandria, VA 22302-0268	2
9.	Prof. Richard S. Elster, Code 54 El Administrative Science Naval Postgraduate School Monterey, CA 93943-5000	1

10. Dean Kneale T. Marshall, Code 05 — 1
Dean of Information & Policy Sciences
Naval Postgraduate School
Monterey, CA 93943-5000

11. LT Joseph L. Johnson, Jr. USN — 2
503 Forest Lane
Towson, MD 21204